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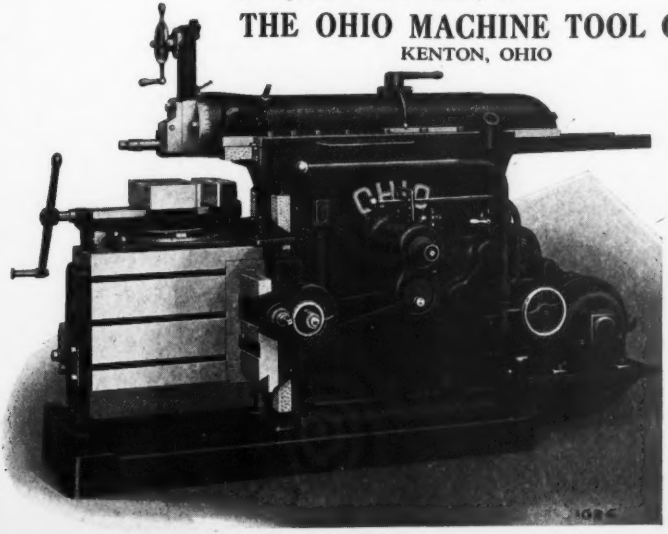

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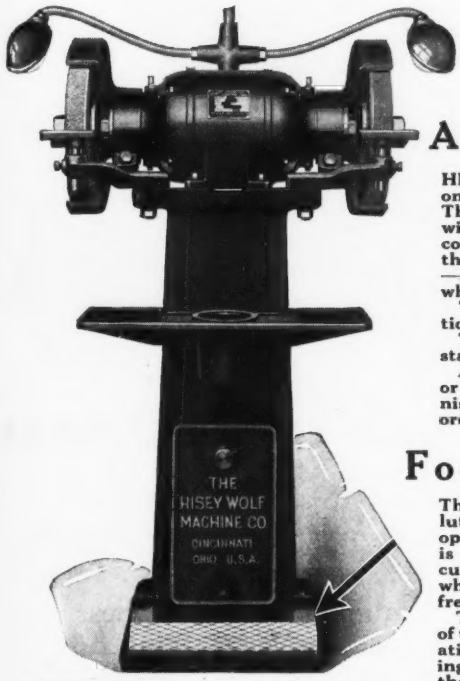
Add Safety—Convenience—Economy to the Tool Grinder



HISEY Foot Treadle Switch can be furnished to order for ½, 1, 2, 2½ and 3½ H. P. Floor Grinders in place of Push Button Control.

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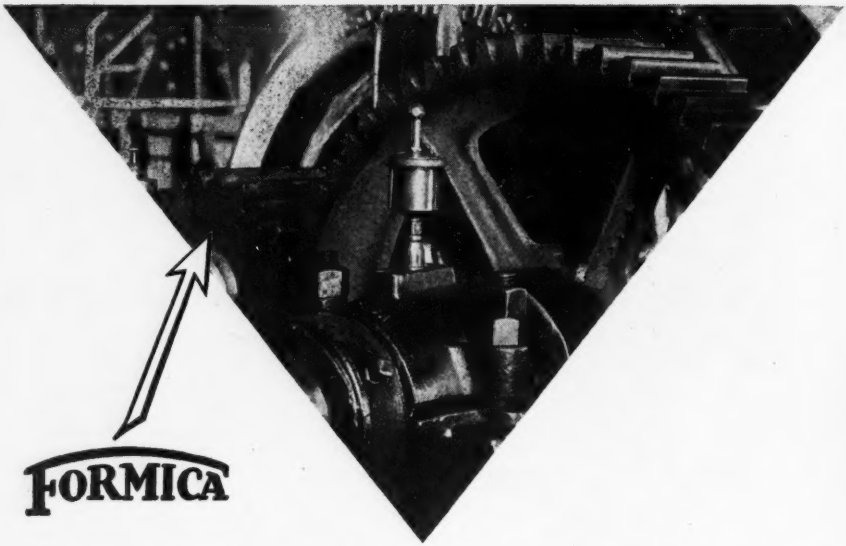

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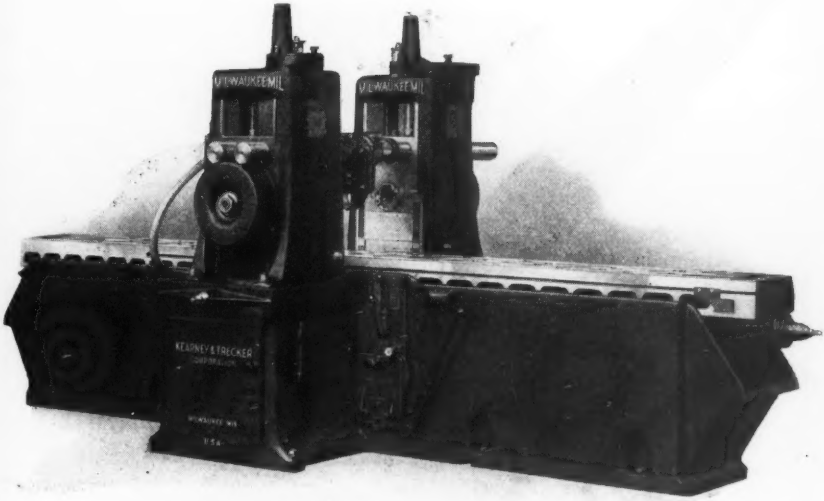

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Yes, with a Thousand Uses—

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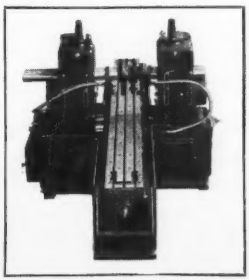
Now look at the heads. The spindles are mounted in solid blocks. There is no quill construction for in and out adjustment—*you move the entire head!* There is no over-hang. Rigidity is at its maximum. Cross adjustment of spindles is 8 inches for machines of the 1400 series and 13¼ inches for the 2200 models.

And don't overlook the optional feed and speed changes—pick-off feed gears for the high production user and quick change selective gear boxes for the user who must make frequent set-ups.



The New Mil-waukee-Mil is NOT a single purpose machine—rather, it is the most versatile miller ever offered in the production field. Better named, we would call it the *milling machine of a thousand uses.*

KEARNEY & TRECKER Corporation
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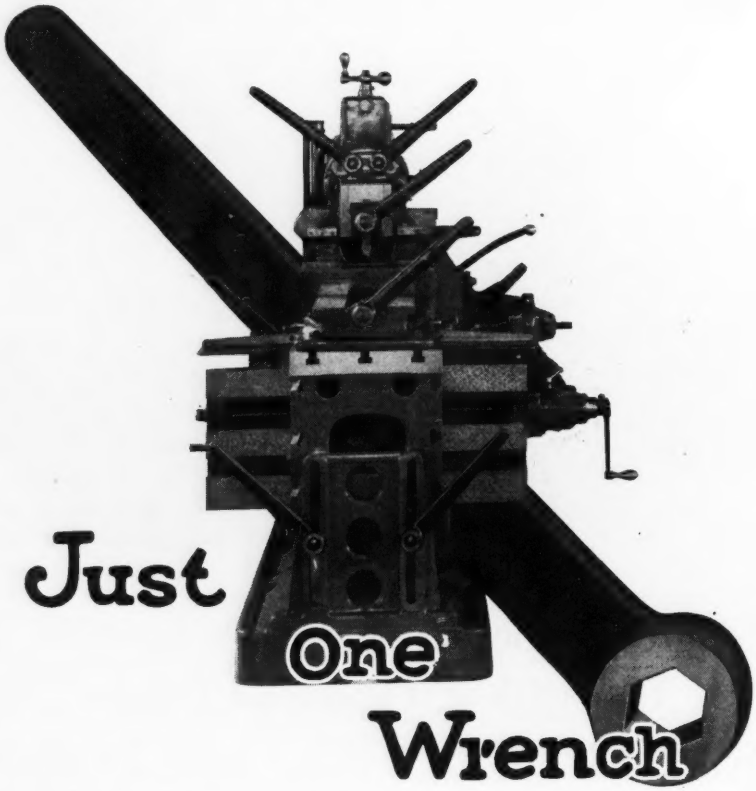

required to make adjustments on the Cincinnati Rapid Traverse Shaper. The same wrench fits them all—tool post, vise, table support, rail clamp and clapper box.

This—like the easy speed and feed changes, the new spring throwout hand feed, the automatic clamp for stroke changes, and power rapid traverse to the table—is just another one of the refinements on the Cincinnati that lessen the set up time.

You should study the many shaper refinements, exclusive to Cincinnati Shapers, described in detail in our catalog. Write for it.

THE CINCINNATI SHAPER CO. :: :: CINCINNATI, OHIO

Cincinnati Shapers
Rapid Traverse

MODERN
Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES

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Vol. 1 DECEMBER, 1928 No. 7

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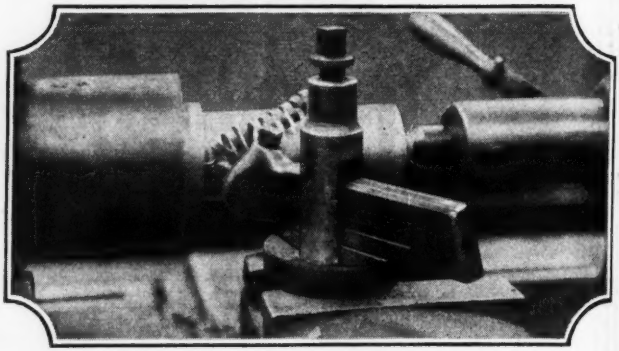

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Make the most of this friendship—take every dollar in reduced overhead, every hour in saved time, it has to offer.

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MODERN Machine Shop

DECEMBER, 1928

CINCINNATI, OHIO VOL. 1, NO. 7

Manufacturing Small Tools

By HOWARD CAMPBELL

PROBABLY a large number of those who use small tools every day have at some time wondered what manufacturing processes these tools pass through. These photographs taken in the plant of Scully-Jones & Co., Chicago, show how "Use-'Em-Up" sleeves, adjustable spacing collars, and Woodruff keyway cutters are made.

The "Use-'Em-Up" drill sleeve is made from bar stock and is turned, drilled, reamed, taper drilled and reamed with a Morse standard taper reamer in the Cleveland automatic screw machine shown in Fig. 1. The illustration shows the piece in process of being reamed with the Morse taper reamer and of having the same taper

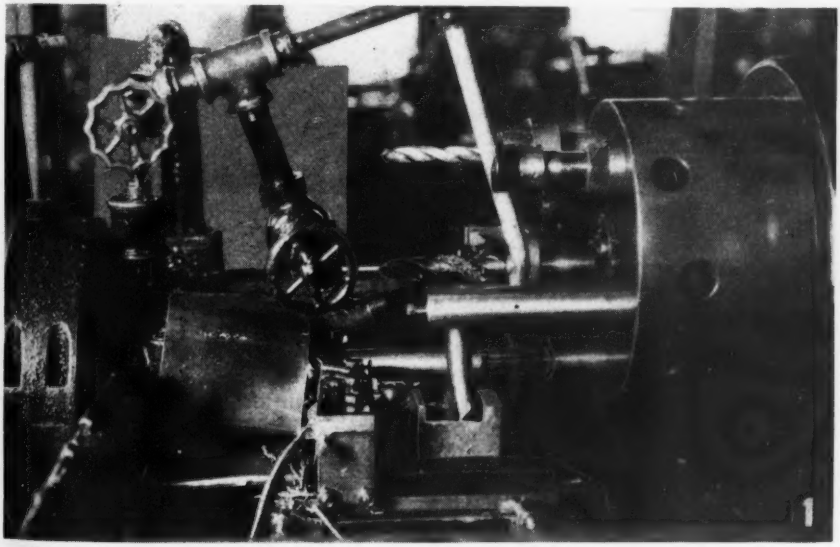


Fig. 1—Turning and reaming tapers on outside and inside of "Use-Em-Up" drill sleeve. The turret operates the taper attachment.

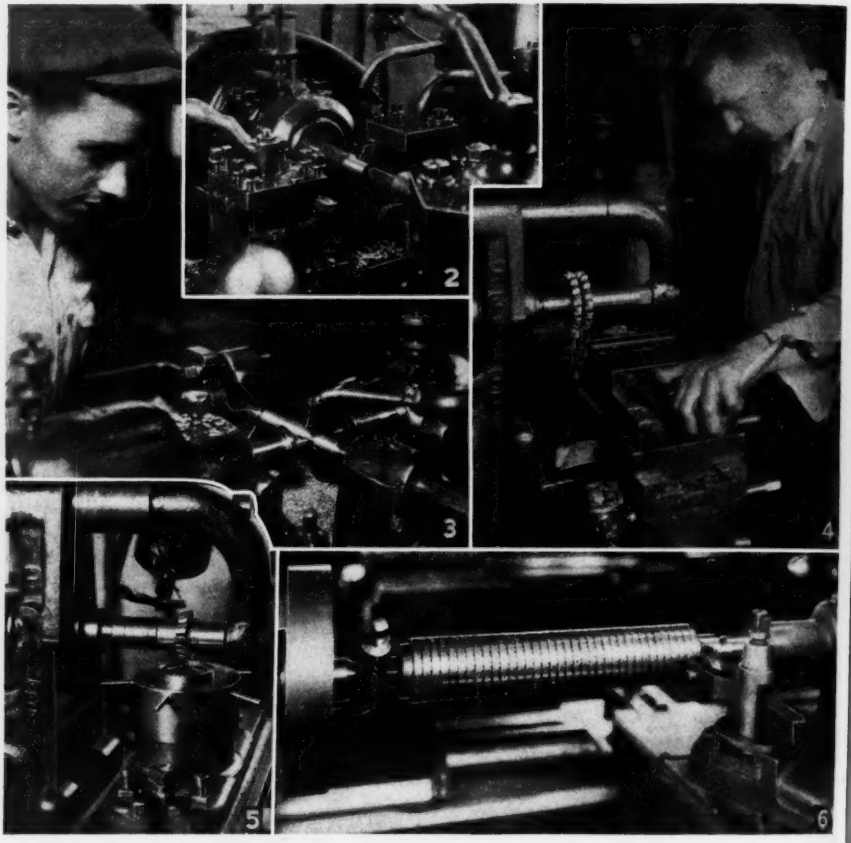
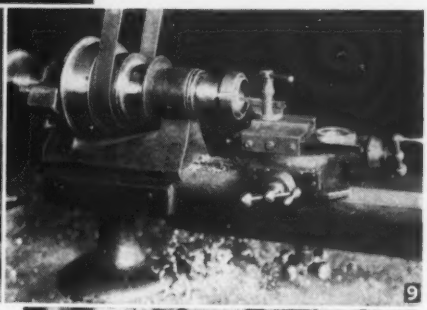


Fig. 2—Turning sleeve after "flat" has been forged in. Fig. 3—Spline milling the drift slot in the sleeve. Fig. 4—Milling the tang. Fig. 5—Milling the teeth in one section of a spacing collar. Fig. 6—Graduating the sections with a circular steel stamp.

turned on the outside of the shank of the sleeve. As no provision is made on the machine for cutting tapers, this operation is performed in an unusual manner. A taper attachment, consisting of a steel bar which has been grooved and into which a corresponding steel slide has been dove-tailed and gibbed, is bolted to the carriage of the machine. The slide carries both the tool holder and a steel block that has been slotted so as to provide for the reception of a lug that is held in one of the turret tool holders. As the turret feeds forward for the reaming operation, the lug, which has engaged the slot in the block, pulls the slide along while the turning tool turns the piece. The slide can be adjusted to any angle to produce a given taper on the work.

After turning and reaming, the sleeve is heated in a furnace until soft enough to forge, then an arbor with a "flat" on one side is inserted in the sleeve and the sleeve is struck a blow

with a power hammer, flattening the side of the sleeve to conform to the shape of the arbor. When cold again, the sleeve is chucked in the hand



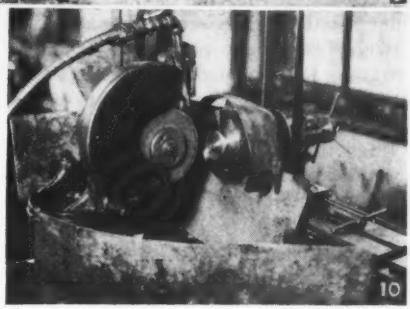
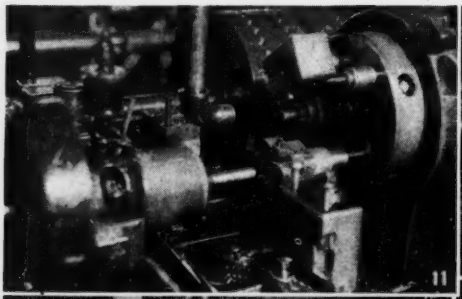


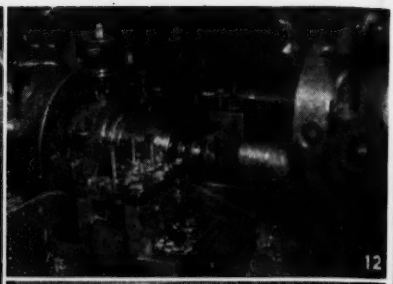
Fig. 7—The heat treating room. The first two furnaces are for carburizing; the other three are used for tempering tools. Fig. 8—Grinding teeth on section of spacing collar after hardening. Fig. 9—Boring knurled ring for press fit on spacing collar section. Fig. 10—The two faces of the assembled collar are ground parallel within .0005 inch.

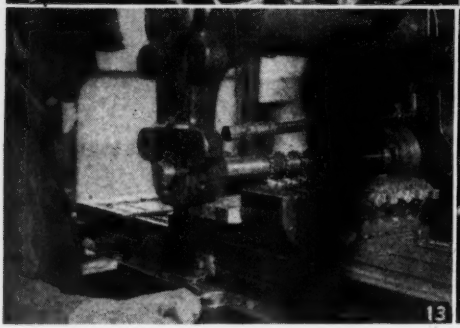
screw machine, shown in Fig. 2, and the body of the tool is turned to size. Thus the outside of the tool is round, while the inside has the "flat" which makes it possible to use drills from which the tangs have been broken or twisted off.

The next operation on the sleeve is that of milling the drift slot, which is done on a Pratt & Whitney spline miller, shown in Fig. 3. The body of the tool is clamped between two jaws and the end of the shank is located on a center. The cutters are fed in from opposite sides simultaneously, and the table is fed by hand to obtain the necessary length of slot. The tang is milled with a hand milling machine and a pair of radius cutters, as shown in Fig. 4. With the exception of burring and stamping, this operation completes the sleeve.

Adjustable spacing collars are made from steel tubing, the two halves which form the collar being turned, bored and cut off in a screw machine. The teeth are then cut in the collars by holding each collar on the indexing fixture shown in Fig. 5 and milling the teeth with a 75 degree angle cutter. Thirty-nine teeth are milled in a collar, divided into segments of thirteen teeth each, each succeeding tooth in







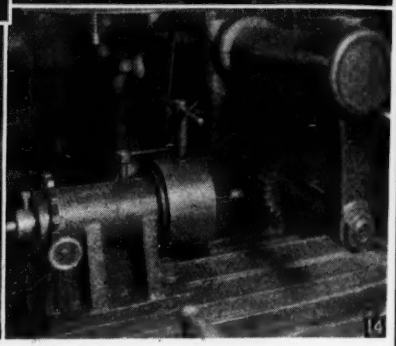


Fig. 11—Turning Woodruff keyway cutters from high speed steel bar. Fig. 12—Cutting off heads of larger sizes of Woodruff keyway cutters. Fig. 13—Milling teeth in keyway cutters. Fig. 14—Squaring shank of cutter for the "Scully-Jones" drive.

each segment being milled .002 inch deeper than the preceding one. Thus twelve steps are provided for adjustments, with a three-point bearing at each step. To obtain the correct height and spacing, the fixture is divided into an upper and a lower half, with three sets of thirteen steps each on the contacting faces. The steps are graduated in height so that each indexing of the fixture raises the work .002 inch.

After the teeth have been milled, thirty-six of the collars at a time are put onto an arbor and put into a lathe to have the teeth numbered, which is done with the tool shown in Fig. 6. The tool is practically a circular stamp, bearing numerals by two's from 0 to 24. Starting with 0 at the first tooth, the arbor is revolved slowly while the steel figures are forced into the periphery of each collar in turn, stamping each tooth with its height in thousandths of an inch from zero.

The collars are now sent to the heat-treating department, Fig. 7, to be carburized. The two large furnaces at the left in the illustration are used for pack hardening, or carburizing, the other three furnaces being used for tempering the high-speed steel cutters. After carburizing, the collars are put onto a "step" fixture on a surface grinding machine, Fig. 8, and both the faces and tops of the teeth are ground. The mechanic is shown using a disk wheel to grind the vertical faces; by using a wider wheel, dressed to a 75-degree angle, the tops of the teeth are ground. This operation puts the cutting edges on the teeth and sharpens them.

(Continued on page 30)

Silent Gears of Steel

Flexible Tooth Steel Silent Gear Means Big Saving in Replacement Costs

CUT out excessive silent gear replacement costs. Get rid of the trouble and expense of shutdowns resulting from tooth breakage. Double-D Steel Silent Gears do both. They provide the strength and life of steel for the job. They retain non-metallic silence. And they reduce tooth breakage to a minimum.

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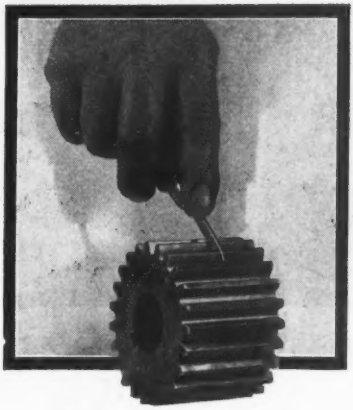

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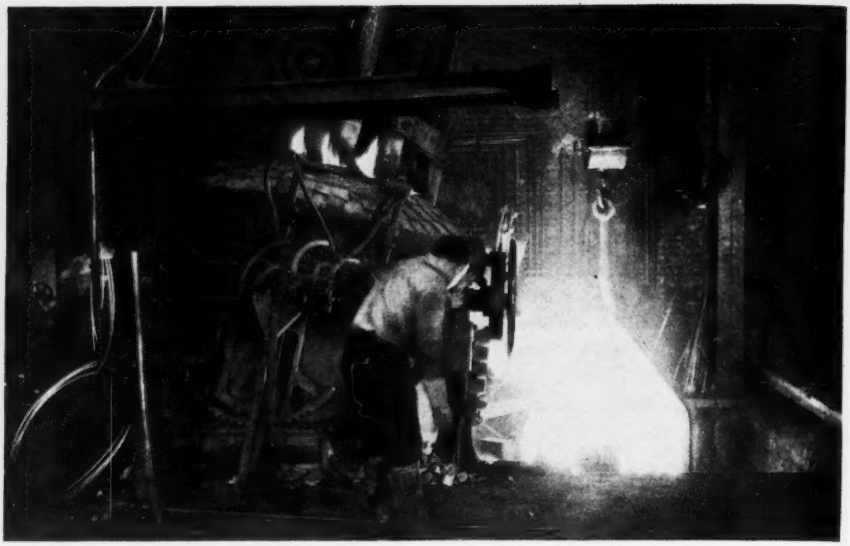


Making Steel Wheels

By AVERY E. GRANVILLE

WHEELS were never so important as they are in these days of seven and eight-ton truck loads. They probably get less attention and more abuse than any other part of the truck, consequently they must be able to "stand the gaff" without failure. In consequence of which most truck manufacturers have long since abandoned the wood wheels of earlier days and are using wheels made of cast steel, which are supplied by manufacturers who are specialists on this class of merchandise.

One of the largest of the wheel manufacturers is the Dayton Steel Foundry Company, located at Dayton, Ohio. This plant operates its own machine shop and foundry, making wheels of any size or type desired—as long as they are of steel—and turning out each wheel complete except for the tire and bearings. The product varies from the light wheels that are used with pneumatic tires to wheels of the heaviest type, upon which solid tires are placed. When running at a normal speed, the plant turns out from 3,000 to 4,000 wheels per week.

The furnace equipment consists of three electric furnaces, one of which is illustrated at the head of this article. The illustration shows the furnace tilted so that the molten steel will run into the huge ladle. Each furnace melts approximately five tons of metal per hour, the two furnaces in use turning out a total of more than 100 tons per day. A close check is kept on the quality of the metal, samples from each pouring being taken

FOSDICK

21-inch Heavy Duty Upright Drill

for all standard drilling jobs

All-geared drive.

Ground column.

Column braced. Brace encloses drive shaft.

Spindle is high carbon hammered steel forging.

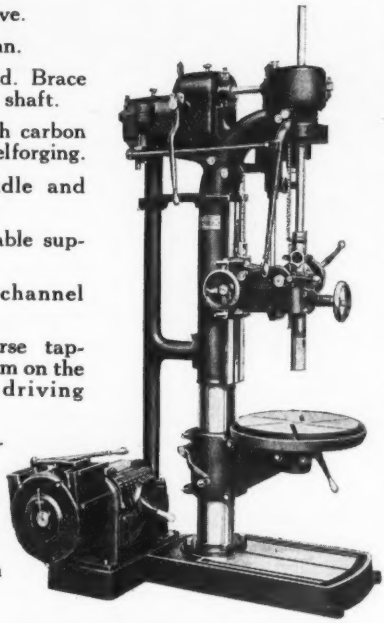
Ground spindle and sleeve.

Extra rigid table support.

Lubricant channel around table.

Friction reverse tapping mechanism on the high speed driving shaft.

Speed box convenient, containing steel gears giving 12 spindle speeds. Five feeds to each revolution of spindle.



Hardened steel bevel gearing to transmit power.

Ball bearing bevel gear thrusts.

Start, stop and reverse friction lever conveniently located.

Worm feed. Worm runs in oil bath.

Duplex feed and quick return.

Power feeds controlled by single lever—can be shifted while drilling.

Automatic trip and depth gauge.

Capacity—2½-inch H. S. drill in steel or 3-inch pipe tap in cast iron.

This machine has been especially designed to meet the demand for a high-grade, rigid, accurate, powerful drill for all kinds of standard drilling and tapping jobs. All-geared drive for drilling, and the most powerful friction reverse tapping mechanism known for tapping.

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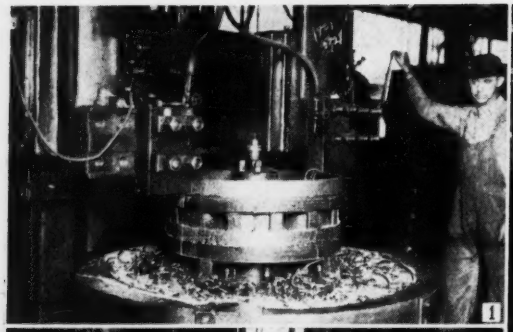
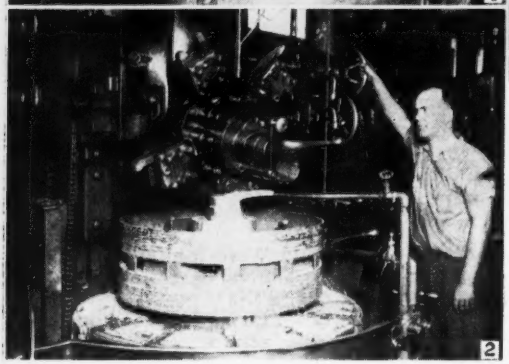
THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.





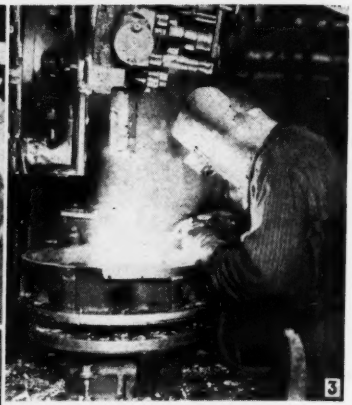


Fig. 1—Rough turning steel truck wheels. Fig. 2—The wheels are finish turned, bored and reamed on the Bullard. Fig. 3—Electric-welding a shrinkhole in the bore.

to the metallurgical laboratory for analysis. In order to obtain the correct chemical properties, steel scrap of guaranteed analysis is purchased for use, but every carload of scrap is analyzed before it is accepted to make sure that it is exactly what is wanted. The ladle is of the "bottom-pour" type, which makes it possible for the ladle to be held by the overhead crane while pouring, thus eliminating a large amount of hard manual labor.

The first machining operation on the heavier wheels is that of rough turning, which is performed on the boring mill shown in Fig. 1. Two heads operate simultaneously on this operation, one turning the upper half of the tread while the other turns the lower half. The tools are 1½-inch square Stellite bits welded onto shanks of much less expensive steel.

The operator shown in Fig. 2 is finish turning, boring and reaming a wheel on a Bullard vertical boring mill. The boring and turning operations are done simultaneously, with forged high speed steel tools, but the reaming operation is performed with a special Kelly reamer. The reamer blades can be set to ream a given diameter, and then can be removed and replaced as desired. In machining the wheel shown, the roughing and semi-finishing operations are performed with blades that are locked in position so that the bore will be machined perfectly true, the semi-finisher being replaced with a finisher that is allowed to "float." A fine finish and an accurate job are produced with these tools.

Occasionally a small shrink hole will be found in a wheel, usually after a cut has been taken across the face or in the bore with a tool. Such a hole would probably have little effect on

"SCULLY-JONES"

FLOATING REAMER AND TAP HOLDER

For Automatic Screw Machines, Turret Lathes, Etc.

Order One On Approval

THE floating action of these Holders permits tools to enter work on a straight line when machine spindle and turret tool holders are off center but in parallel alignment.

Taps produce threads with uniform pitch diameters. Reamers finish holes to size.

SHORT SHANK TOOLS are recommended for use with this style holder. Collets with standard taper sockets to accommodate "SCULLY-JONES" Tap and Reamer Chucks are advantageous when several sizes of tools are used at intervals.

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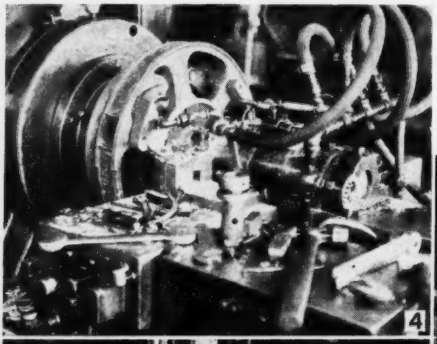
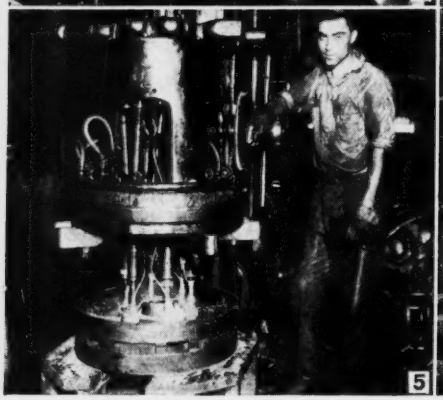
the strength or serviceability of the wheel, but in order that the wheel may be as nearly perfect as possible, the hole is filled with metal by electric welding. A welder is shown at work in Fig. 3, welding a small hole in the bore of a wheel that has been partly machined. The electric process fuses the "filler" metal with the original steel and a weld thus produced is fully as strong as the rest of the wheel. Such a weld can be made in from two to three minutes.

Some of the lighter wheels are machined on automatic lathes similar to that illustrated in Fig. 4. The wheel is held by three special chuck-jaws which are pivoted so that they can be swung into position instantly. The wheel is centered by a plate on the chuck, which fits around the hub. The wheel is rough bored, the hub is faced, the lugs are faced, the hub is turned, a counterbore is machined, and the bore is reamed, all in one operation. As soon as the boring operation is finished, the boring tool withdraws and a reamer enters from the rear. The reamer is located in the spindle and is operated by a cam. The machines are arranged in pairs, facing, so that one mechanic can operate two machines. A wheel is produced complete in ten minutes.

The bolt holes in the truck wheels are drilled with multiple drilling machines, one of which is shown in operation in Fig. 5. The wheel is held in position by a hook-bolt which is inserted through the bore, the hook





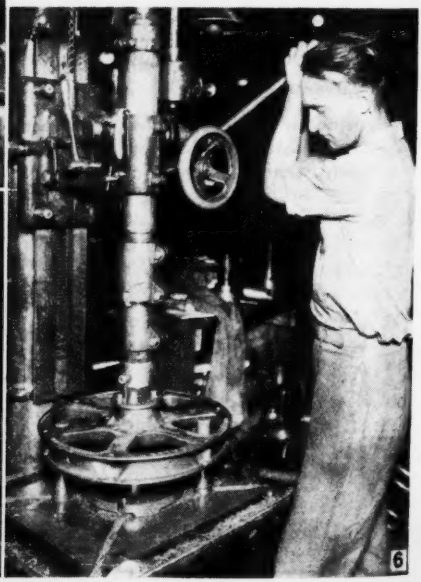
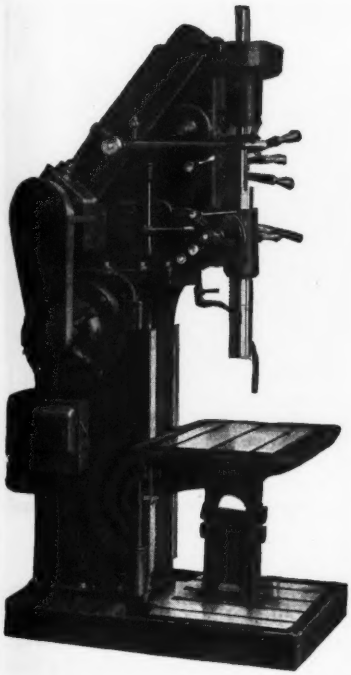
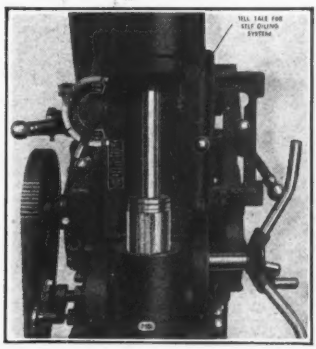


Fig. 4—Lighter wheels are machined on the automatic turret lathes. Fig. 5—Bolt-holes are drilled in the wheels with the aid of a multiple drill. Fig. 6—A drill press and collapsible tap are used to tap the hubs.





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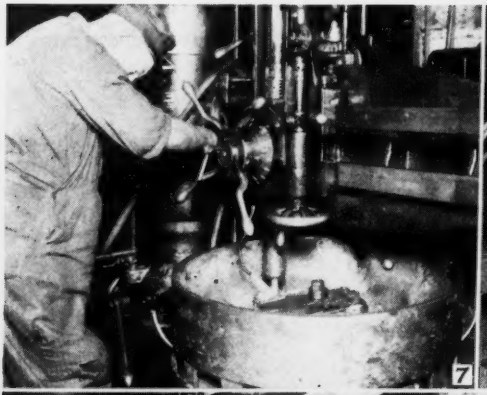

Fig. 7—Milling burrs off the under side of the flange. Fig. 8—Chain lugs are riveted onto the large wheels. Fig. 9—Each dimension of the wheel is re-checked in the final inspection.

at the lower end catching around a bar while the upper end is used to hold a clamp.

The mechanic shown in Fig. 6 is tapping the hub of a White truck wheel, using a drill press and a Murchey collapsible tap to perform the operation. All of the lighter wheels that have threads in the bore are tapped on this machine.

In drilling the bolt-holes, a burr is thrown up that has to be removed. This operation is done on a radial drill press and the machining is done with a side milling cutter, as shown in Fig. 7. The cutter arbor is held in the spindle of the machine and the mechanic manipulates the radial arm and machine spindle so as to machine the complete circle on the under side of the flange.

The machining having been completed, some of the large solid-tire wheels are given sets of chain lugs, which are riveted on as shown in Fig. 8. The last operation is the final inspection, during which every part and dimension of the wheel is gauged and inspected to make sure that it comes within the customer's specifications. The final inspector, with his set of micrometers, thread gauges, snap gauges, plug gauges, and other tools, is shown in action in Fig. 9. The entire set of inspection gauges is checked up with master gauges and Johannson blocks at regular intervals to eliminate the possibility of error.

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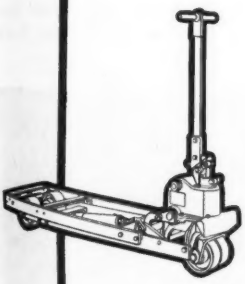

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"Stelliting" Machine Parts for Long Wear

By F. J. FITZGERALD

STELLITE, which is an alloy of chromium, cobalt and tungsten, has been used as a cutting tool in machine shops for nearly two decades, and most metal-working executives and mechanics are familiar with it. Of its outstanding properties, the most important are its ability to retain its hardness almost unimpaired up to a bright red heat, and its great resistance to abrasion. Exhaustive tests have proved conclusively that Stellite will outwear steel on an average of from four to six times. This fact has led to the development of an economical method of applying Stellite to worn machine parts at the points where the wear occurs, and the number of firms who are using this method to insure better operation of their equipment and reduce maintenance costs is steadily increasing.

The method consists of building up worn spots with Stellite, which is applied with an oxy-acetylene blowpipe. Parts that are worn undersize are readily built up again, and expansive surfaces on large machinery upon which considerable wear comes are surfaced with Stellite. Expensive dies of high-grade steel are made to serve long terms of usefulness when surfaced in this manner, and old dies are given new leases of life by the same process.

Stellite can be applied by the oxy-acetylene blowpipe to almost every metal in common use. Any grade of steel, no matter what the carbon content, can be Stellited and alloy steels of all compositions are readily surfaced. Cast iron, semi-steel and malleable iron can also be Stellited successfully. To "Stellite" a surface success-

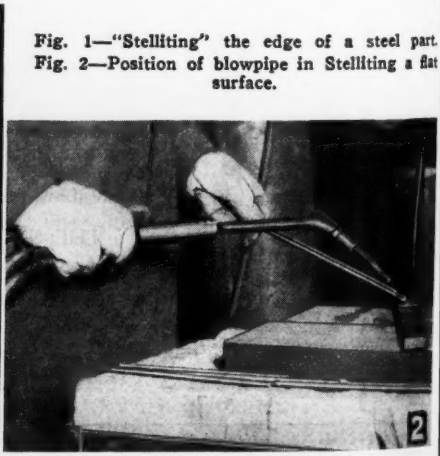
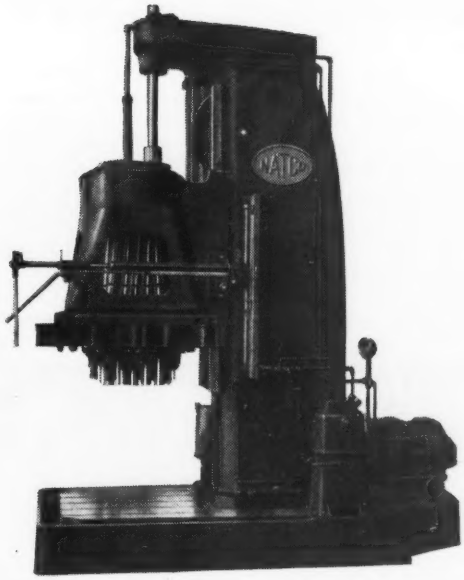


Fig. 1—"Stelliting" the edge of a steel part.
Fig. 2—Position of blowpipe in Stelliting a flat surface.



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fully, however, two things must be avoided: (1) blowholes on or underneath the Stellite coating, and (2) checks or surface cracks caused by uneven cooling. If the instructions given here are followed, no trouble will be experienced.

Thorough preheating and annealing of the base metal is most essential. Although the melting points of steel and Stellite do not differ greatly and the co-efficients of linear expansion are the same, Stellite goes from the liquid to the solid state more quickly than steel, when both are cooled in air. Therefore, unless the steel is preheated evenly, kept up to heat, and cooled slowly, internal stresses may be set up which will be great enough to check the Stellited surface. Proper preheating also facilitates the Stelliting operation and the quick removal of scale.

Fig. 3—Method of building up a hammer mill with Stellite. (1) New Steel hammer. (2) Hammer with corners Stellited. (3) After grinding corners. (4) Stellited hammer after 92 hours' use. (Steel lasts 14 hours).

The technique which has been developed for Stelliting differs in some ways from any other operations with the welding blowpipe. First, the flame should be almost parallel with the surface being Stellited, and two or three inches of the rod should be enveloped by the flame. This keeps the rod hot so that when the base metal begins to "sweat," the Stellite can be flowed on quickly. Speed is essential. Furthermore, the horizontal flame lessens the possibility of heating too deeply into the base metal and forming a "crater," which causes trouble in obtaining a clean surface of pure Stellite. The clean Stellite surface, free from blowholes or iron alloy, is the effect that must be obtained.

The only other precaution to be emphasized is that all scale, dirt and foreign material must be removed before the Stellite is applied. If such material remains, it will cause blowholes and thus ruin the job.

In applying Stellite to most metal parts, preheating is quite necessary to avoid the setting up of internal stresses. The usual preheating apparatus can be used, and charcoal, oil or gas may be employed. On small steel pieces the blowpipe may be used, as a quick surface heat only is required. For the occasional bulky casting, a temporary charcoal and fire-brick furnace will prove satisfactory. Where the work is repetitive, however, a permanent oil or gas furnace can be more economically employed.

Where a temporary fire-brick furnace is used, the annealing of the piece can be accomplished in it. Otherwise, a box or bin filled with some heat-resisting material, such as slaked lime, asbestos fiber or sil-o-cel, should be provided. The bin should be constructed so as to enable the piece to be completely submerged in the filler. The piece should be maintained at an even heat during the Stelliting operation and should be completely covered, except for the opening through which the operator

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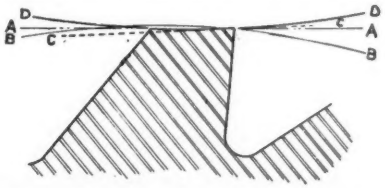
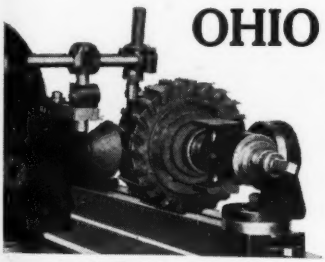


DD represents periphery of grinding wheel, BB circumference of cutter, AA desired clearance as obtained with cup wheel on Ohio Grinder, CC clearance angle obtained using periphery of grinding wheel for clearance.



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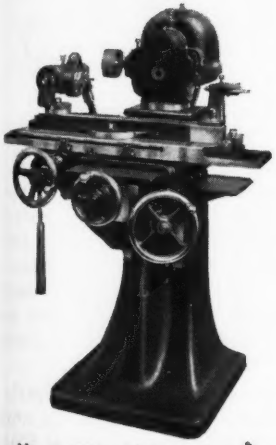

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works. If necessary to remove the piece from the furnace during the Stelliting operation, it should be covered with asbestos paper to protect it from drafts and thus prevent uneven cooling.

An excess acetylene flame should be used, the valves being regulated so that the outer cone is double the length of the inner cone. Where too little acetylene is used, the puddle will foam and bubble, forming blowholes, caused by the oxidation or burning of some of the constituents of the Stellite. If too much acetylene is used, a coating of carbon will be deposited around the Stellite puddle, but too much is better than too little.

When the surface to be built up is of small area, it may be entirely tinned at one time. The flame should be played on a small area in one corner of the piece until its temperature is elevated to a point where the carbon coating deposited by the reducing flame disappears and the base metal begins to sweat. The rod should be brought to its fusion point at the same time by immersion in the blowpipe flame, then a drop of the Stellite should be allowed to drop on and fuse with the sweating base metal. If the Stellite gathers in a ball, it indicates that the parent metal has not been brought up to the proper temperature and must, therefore, be heated further.

When properly applied, the Stellite should flow in and fuse readily with the parent metal. In tinning the remaining surface, the blowpipe flame should be kept ahead of the melted pool of Stellite in order to bring the parent metal up to the proper fusion temperature as the work progresses. The Stellite rod should be agitated as little as possible and prevented from digging into the parent metal.

If the parent metal is properly heated, the Stellite will run under any scale or other impurities and will float them to the surface. If the parent

(Continued on page 36)

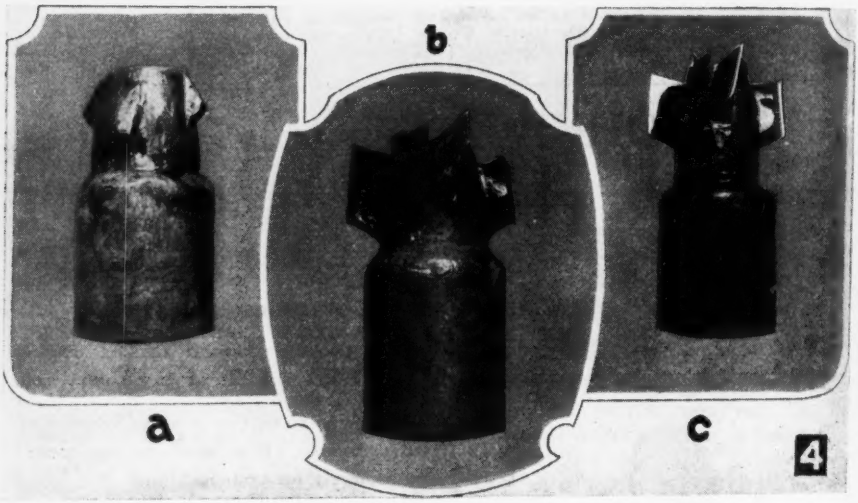

Fig. 4—Core barrels (used in oil fields) built up with Stellite. (a) Worn-out core barrel. (b) Built up with steel. (c) With teeth Stellited.

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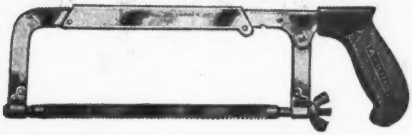
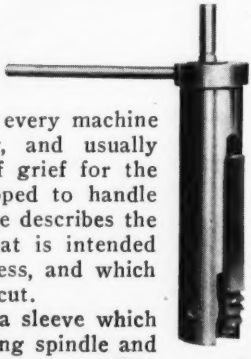


Atkins No. 11 Hack Saw Frame

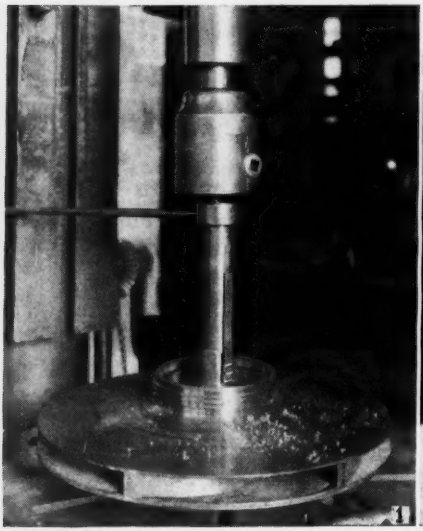
Milling Internal Keyways With the Drill Press

By DONALD A. CLARK



THE cutting of an internal keyway is a job that comes to every machine shop sooner or later, and usually brings with it a lot of grief for the shop that is not equipped to handle it properly. This article describes the operation of a tool that is intended for use with a drill press, and which mills a keyway in one cut.

The tool consists of a sleeve which serves to house a driving spindle and a high-speed steel milling cutter. The upper end of the spindle is turned to form a shank that can be gripped in a drill press chuck and the lower end of the spindle carries several inserted chrome vanadium steel driving pins, which engage the backs of the cutter teeth as the spindle revolves and thus force the cutter to turn. The tool is prevented from turning with the machine spindle by means of a bar that extends back from the rear of the tool and rides against the side of the machine column. The teeth on the cutter are ground "staggered," or with one-half of one tooth cutting and the opposite half of the next tooth cutting. By grinding the cutter teeth in this manner, the chips are broken up and the cutting edge is



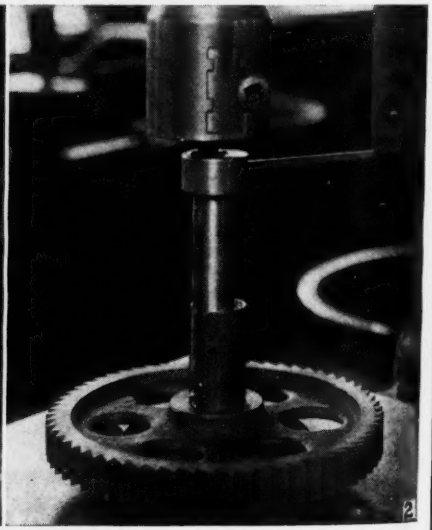
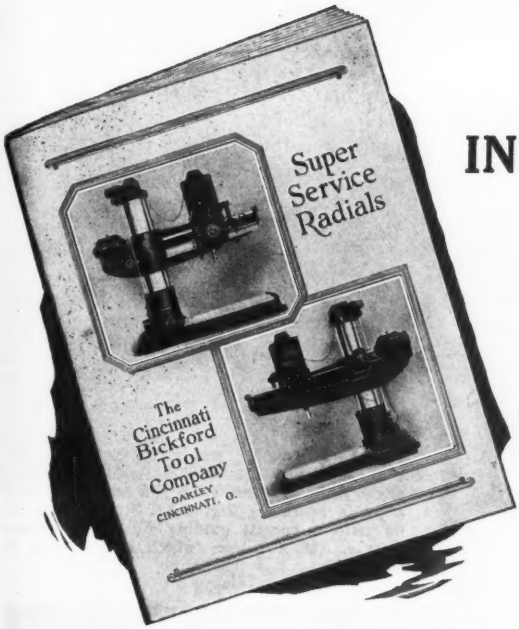


Fig. 1—Milling a keyway in the shaft hole of a pump disk. Fig. 2—Keyseating a ratchet wheel. Note the "staggered" manner of grinding the cutter-teeth.



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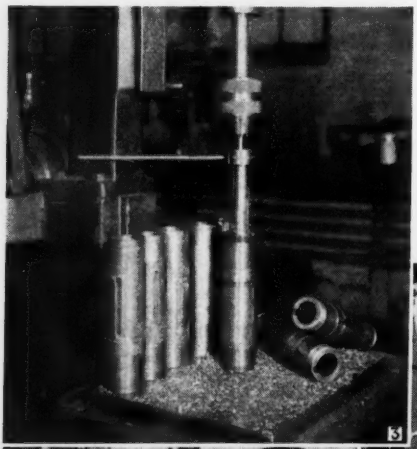
shortened so as to reduce the strain and wear on the driving pins. A guide on the front of the tool enters the keyseat as soon as the cut is started, thus insuring that the keyway will be cut straight.

An example of the more common type of work for which this tool is used is shown in Fig. 1. The piece is a disc for a centrifugal pump, in which the shaft hole is so large as to necessitate the use of an eccentric bushing with the keyseating tool. The tool used is 1¼ inches in diameter, and is milling a ⅜-inch wide keyseat. The combination of eccentric bushing and guide—which is the straight vertical piece just above the cutter—makes it unnecessary to clamp the piece in position.

The keyseating of gears and ratchets also forms a large part of the work that this tool is called upon to do. Fig. 2 shows a 1¼-inch diameter keyseating tool just starting to mill a $\frac{7}{16}$-inch keyway in a ratchet wheel. The "staggered" method of grinding the teeth on the cutter can easily be



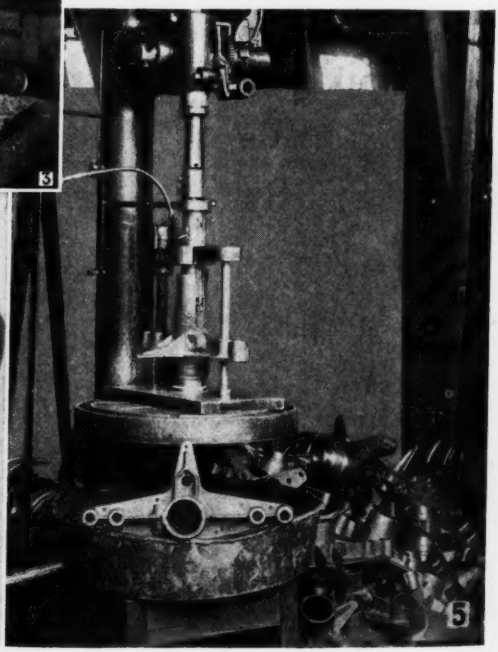
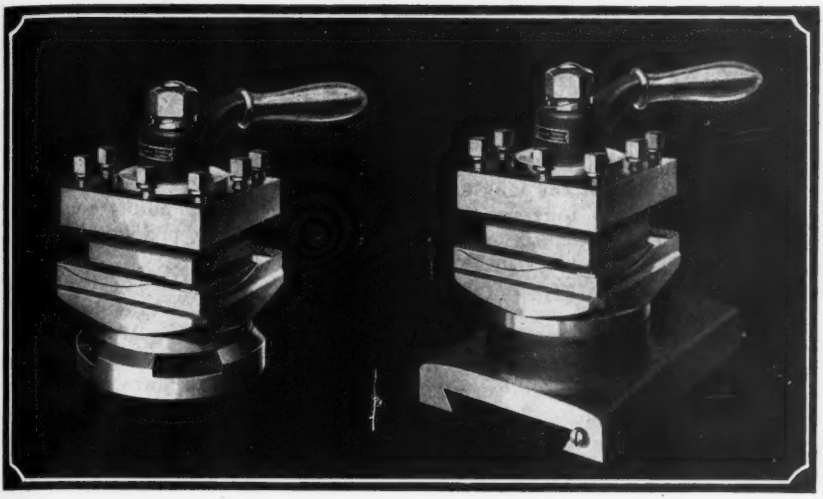
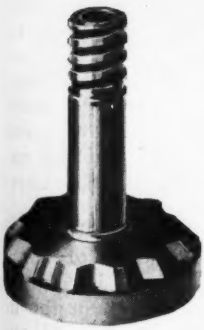


Fig. 3—Keyseating a steel sleeve. The keyway ends part way through. Fig. 4—Milling keyways in the interior of a steel frame, using a guide bracket. Fig. 5—A steel casting set up with a special guiding jig. The keyway ends at the shoulder, which can be seen in the hole.





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McCrosky Turrets

seen in this illustration. A 1¾-inch eccentric bushing is used in this case to give the tool the necessary support.

The use of the tool for milling keyways in steel sleeves is shown in Fig. 3, a 1½-inch tool being used with a 1¾-inch eccentric bushing. The keyway ends at about half the length of the piece, which fact, together with the great length of the piece, would make this a difficult job to machine accurately by some of the more ancient methods.

A circular steel frame is shown in Fig. 4 in process of having fourteen keyways milled on the inside of the casting, which is 10 inches long. In this case, a 1-inch diameter keyseating tool with a ¼-inch cutter is used, the necessary support being supplied by a guide bracket that is bolted to the machine table, inside the casting.

A set-up for milling a ¼-inch keyseat in the center hole of a large steel casting is shown in Fig. 5. The hole is 2¼ inches diameter, and has a shoulder near the center at which the keyway ends, as shown by the piece lying on its side on the bench. This job necessitates the use of a special guiding jig, which can be seen set up on the table of the machine. A 1¾-inch tool with a 2¼-inch eccentric bushing is used for this job.

These few examples will serve to show how antique methods of performing a common operation have been superseded by a product of modern engineering skill.

(Illustrations and data courtesy National Machine Tool Co.)

Manufacturing Small Tools

(Continued from page 10)

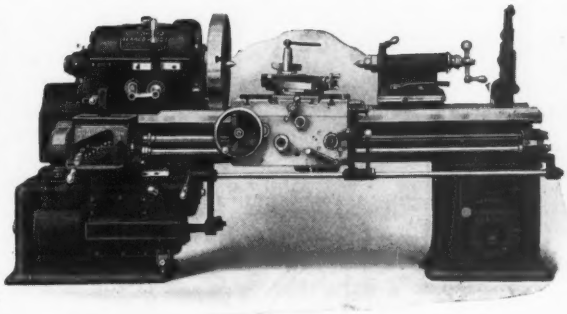
At this point another part is added to one-half of the collars. The part consists of a steel ring that has been turned, beveled, knurled and cut off from a length of steel tubing in an automatic screw machine. The final operation on the ring consists of chucking in the bench lathe shown in Fig. 9, and boring .002 inch under the diameter of the collars. It is then pressed onto a collar so that when the two halves of the collar are assembled, the ring will serve as a finger grip when making adjustments and will also serve to protect the teeth from chips.

After the two parts of the collar have been assembled together, it is put onto an expanding stub arbor on the grinding machine shown in Fig. 10 and the outer faces are ground parallel. They are also ground to a given thickness within a limit of .0005 inch.

An automatic screw machine is shown in Fig. 11, turning solid keyway cutters from a bar of high-speed steel. Cutters up to and including No. 6 are made from solid stock; for the larger cutters, heads only are made from high-speed steel, each head being welded to a carbon steel shank. The illustration Fig. 12 shows a cutting-off tool in a screw machine cutting off a head after it has been "necked."

Teeth are milled on the Woodruff keyway cutters in gangs of seven, using the fixture shown in Fig. 13. Each one is then chucked in the indexing fixture shown in Fig. 14, and the end of the shank is milled square for the "Scully-Jones" drive. All burrs are now removed and the cutters go to the hardening room. Each lot of cutters is first put into the furnace shown farthest at the right, Fig. 7, where they are heated to 1,050 degrees. They are then moved over to the second furnace and heated to 1,550 degrees, again being moved to the third furnace, where they are heated to between 2,350 and 2,400 degrees. At this point they are quenched in oil, which gives them the necessary hardness and temper.

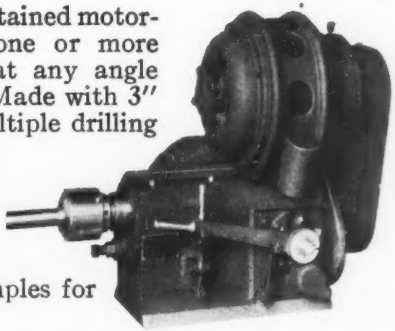
SINGLE LEVER CONTROL *of* BRADFORD ALL-GEARED LATHES



A single lever conveniently located in front of lathe *starts, stops* and *reverses;* also single lever for *changing speeds.* These features together with the *patented low drive* make the BRADFORD *all-geared* lathe a producer of *much better lathe work* and *more of it.* Made in sizes from 14″ to 48″ inclusive. Let us tell you more about this quality tool. Your catalog is waiting.

BRADFORD "UNIMATIC"

For *Drilling* and *Tapping* in *Quantity*



The UNIMATIC is self-contained motor-driven head, designed for one or more heads built into one unit at any angle from horizontal to vertical. Made with 3″ or 6″ stroke for single or multiple drilling up to 1⅛″ and tapping up to 1″ in steel. Sold as a separate head or made up into complete machines for any particular job.

Send us your prints or samples for production estimates.

THE BRADFORD MACHINE TOOL COMPANY

659 EVANS STREET CINCINNATI, OHIO

Precision Lathe Builders Since 1840

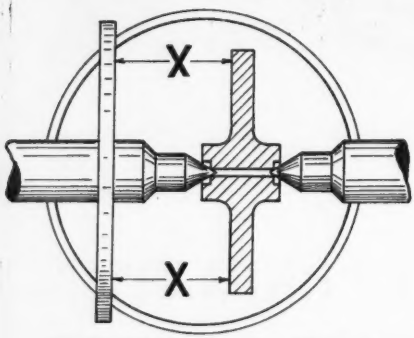
Ideas From Readers

This department is a clearing-house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Lathe Center Alignment Test Gauge

By C. T. SCHAEFER

ALIGNMENT of lathe centers is sometimes disturbed or purposely altered in order to turn a taper, and it is quite a job to line up the tailstock with the headstock so that parallel cuts can be taken again. A centering gauge simplifies the problem. This gauge can be made from a disc into which a small hole is drilled, not more than ⅛-inch in diameter. The disc can be of any convenient diameter, but it should be faced so that the faces will be at perfect right angles to the centering hole. This is necessary, as the accuracy of the centers depends upon the accuracy of this angle.



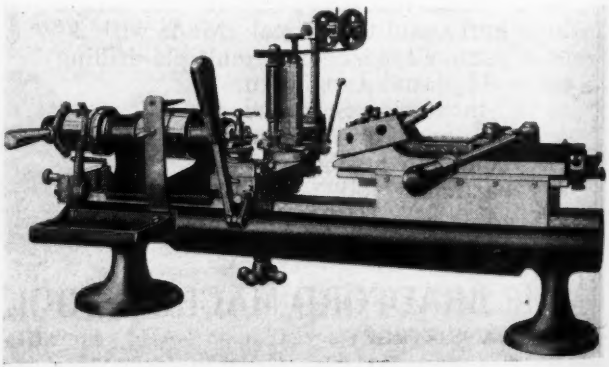
Testing Lathe Centers for Alignment

To use the gauge, the tailstock is moved up to the headstock and the gauge is placed between the centers as illustrated. Measurements are then taken at the periphery of the disc at diametrically opposite points as shown. If the dimension "X" is the same at one point as it is at the other, then the lathe is centered. If not, the measurements will show which way the tailstock must be moved to align the centers.

Cutting Bevel Gears On a Bench Lathe

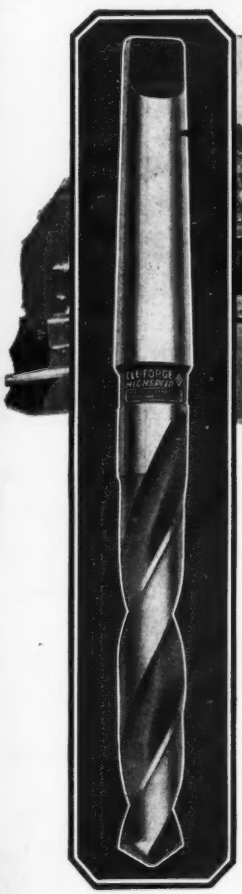
By HENRY M. CLARY

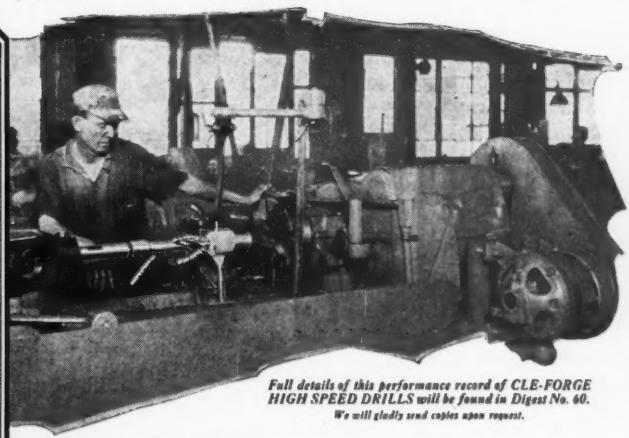
HAVING a large quantity of very small 16-tooth bevel gears to cut for use on dental equipment to drive



Bevel gears are made and cut complete with this outfit.

50% More Holes—32.8% Lower Cost!





Full details of this performance record of CLE-FORGE HIGH SPEED DRILLS will be found in Digest No. 60. We will gladly send copies upon request.

FOUR years ago a large oil well tool corporation made a test of four different makes of high speed drills.

For each make, the speed and feed was set at the point where the chips came out blue through a good average flow of lubricant.

Out of this test emerged

CLE-FORGE HIGH SPEED DRILLS
TRADE MARK REG. U.S. PAT. OFF.

with somewhat higher limiting speeds and feeds—and with an average of about 50% more holes per grind!

On one typical job at this plant, investigated in the Spring of 1928, it was shown that the high speed drills formerly used averaged 15 holes per grind (as compared with 22 holes per grind for CLE-FORGE); a total life of 1500 holes per drill (as compared with 2,200 holes for CLE-FORGE); a unit cost of 67c per 100 holes drilled (as compared with 45c per 100 for CLE-FORGE)—

And that CLE-FORGE HIGH SPEED DRILLS *cost* exactly 32.8% less, although the initial *price* of each drill was identical.

CLE-FORGE HIGH SPEED DRILLS are offered to you on the soundest basis in the world—on the basis of their *proved performance* in actual daily operation.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND
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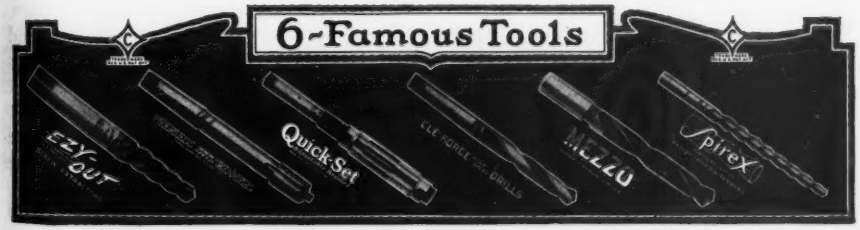
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

Manufacturers of Carbon and Cle-Forge High Speed Drills for every purpose; "Mezzo" Super-Carbon Drills; Hand, Jobbers' and Shell Reamers; "Peerless" High Speed Reamers; "Paradox" Adjustable Reamers; "Quick-Set" Reamers; "Spirex" Machine Taper Pin Reamers; Chucking Reamers for Turret Lathes; Counterbores; Countersinks; Sockets; End Mills; and the "Ezy-Out" Screw Extractor.



the drills and other small tools that a dentist uses, we designed the apparatus shown in the illustration as being the quickest way to do the job. The gears are made from bar stock, a form tool, clamped in the tool holder, being used to turn the gears to size and shape. As each piece is turned, the tool also cuts off the preceding gear, in which the teeth have been cut.

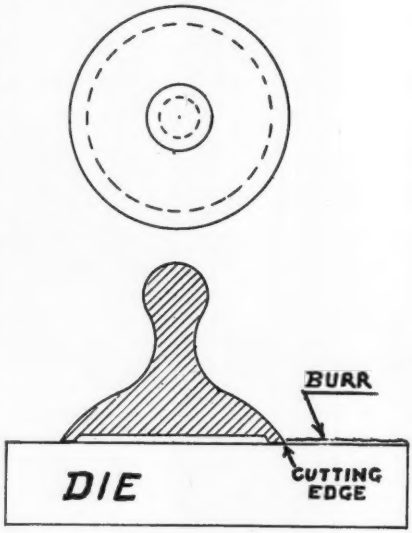
The tooth-cutting mechanism consists of an angle plate that is bolted to a tool slide which is located on the rear end of the cross slide, the angle plate serving as a support for the cutter arbor and as a base for a small countershaft support. The arbor is vertical, with the cutter at the lower end and a pulley at the upper end, which is driven by a belt that is driven from an overhead shaft. With the slide set at the correct angle, each tooth is cut by feeding the slide by hand. An indexing arrangement on the rear end of the lathe spindle provides for the spacing of the teeth. The gears are drilled and counterbored with tools held in the turret in the usual manner.

A Burring Tool for Die-Makers

By CHARLES KUGLER

IN spite of the fact that the file in a filing machine cuts on the downward stroke, it always raises a burr on the top of the work. This burr is very annoying to the die-maker who is trying to split a scribed line on the surface of a die, and before making the tool shown, the writer had never seen a satisfactory method of removing the burr without disturbing the line.

The tool is made of tool steel, turned to form a disk with a handle on the top, as shown, and hardened, ground and lapped on the edge so that the burr can be easily sheared. The tool can be made any size suitable for the purposes of the user. The



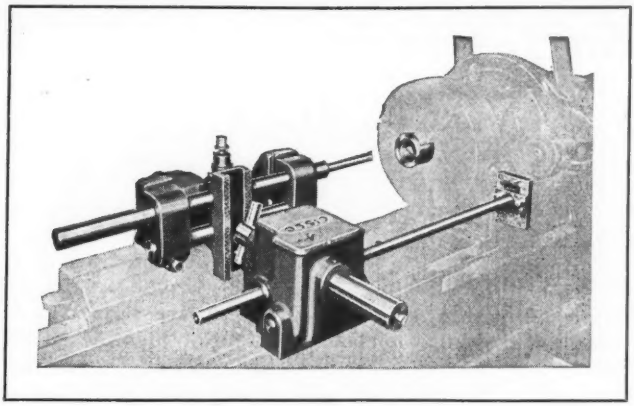
Burring Tool for Die-Makers

one made by the writer is ¾ inch diameter by 1 inch high, which is a convenient size for fine work.

Handy Filler for Driving Box Cellar Fits

By "BACKWOODS MECHANIC"

WHEN preparing locomotive driving boxes for the application of brass or babbitt metal hub faces, appliances of a more or less makeshift type are sometimes used to close the opening provided for the cellar. Plates, separated by means of blocks and wedges, or forced against the sides of the cellar fit by means of a bolt and nut are often used, the plates being adjusted to project about one inch beyond the hub face. After the plates have been tightened into place, the openings between the plates and



How Do You Oil Groove Bearings?

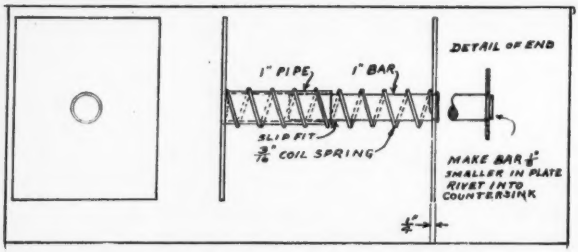
ARE you still using the old method of chipping oil grooves? The CISCO UNIVERSAL LATHE OIL GROOVING ATTACHMENT was designed to relieve manufacturers of the costly operation of chipping oil grooves. It is readily attachable to any make of lathe from 14" to 24" inclusive.

This attachment cuts single, double, triple, or quadruple oil grooves of the figure eight type, inside or outside of the bearing. The depth of the groove is controlled by the operator. The diameter of the work ranges from 5/8" to the maximum capacity of the lathe used. Made in three maximum lengths of 6", 9", and 12". The variety of the work that can be oil grooved is very great.

Wherever installed, the attachment will pay for itself by the increase in production, and the time saved. Upon receipt of your request, we will be glad to send you bulletins and explain this attachment more in detail.

The Cisco Machine Tool Co.

1765-69 ELMORE STREET CINCINNATI, OHIO



A Handy Filler for Driving Box Cellar Fits.

driving box are filled with clay to prevent the escape of the molten metal when pouring.

The device shown in the illustration is believed by the writer to be the quickest and most effective method of stopping off the cellar opening.

The two ¼-inch plates are of a size to correspond to the size of the driving box to be lined. A 6 x 8-inch plate will take care of the average size box. The one plate is drilled and tapped for a 1-inch pipe, and the opposite plate is drilled ⅞-inch and countersunk on one side. A pipe with a length of not less than one-half the size of the cellar opening is screwed into the threaded plate. A 1-inch bar reduced to ⅞-inch at one end is fitted to the other plate and riveted over into the countersink. When the plates are assembled as shown, with a stiff coil spring to force the two units apart, the spring is compressed to enter the assembly into the driving box. When in position, the spring holds the assembly firmly in place.

Stelliting Machine Parts

(*Continued from page* 24)

metal is not hot enough, however, the Stellite will flow over the scale and in covering it will form a blowhole at this point. Scale is removed in the same manner that sand is removed in cast iron welding, the flame being played on the surrounding metal until the impurity is floated in it. The parent metal should not be melted any deeper than is necessary, however.

After the surface has been tinned and thorough fusion and elimination of blowholes accomplished, it may be built up to the required dimensions. In building up, one corner of the tinned surface should be brought up to its fusion point, which will be indicated by its oily appearance, and the filler rod added as in the tinning operation. Care should be exercised to confine the limits of the Stellite puddle to the enveloping blowpipe cone in order to prevent oxidation. In Stelliting cast iron, the two metals intermingle more or less during the tinning operation, consequently it is necessary to add a heavy top layer of Stellite in order to insure that the surface be pure metal.

After the operation has been completed, the piece should be reheated until an even temperature is secured throughout, and should then be cooled slowly and evenly in some form of bin or furnace. If the piece has been Stellited in a temporary fire-brick furnace, sufficient charcoal can be added to obtain the desired effect. All openings should then be covered with asbestos paper and the piece allowed to remain in the furnace until it has completely cooled.

There are many kinds of machines in which such parts as cams, trips, pawls, guides, and so on, are subject to considerable wear. The application of Stellite to such parts not only increases the life of the parts, but also reduces the time lost in making repairs.

Only through advertising can you tell the world and keep it told.

For Tool and Cutter Grinding

The New Norton "B" Wheel

From tool rooms everywhere come enthusiastic reports on the "B" wheel—on its smooth, fast, cool cutting action, on the way it holds its shape and requires little dressing, on its special effectiveness on hard alloy steels.

To the well known tool grinding features of 38 Alundum abrasive are added in this wheel the advantages of an entirely new bond and manufacturing process.

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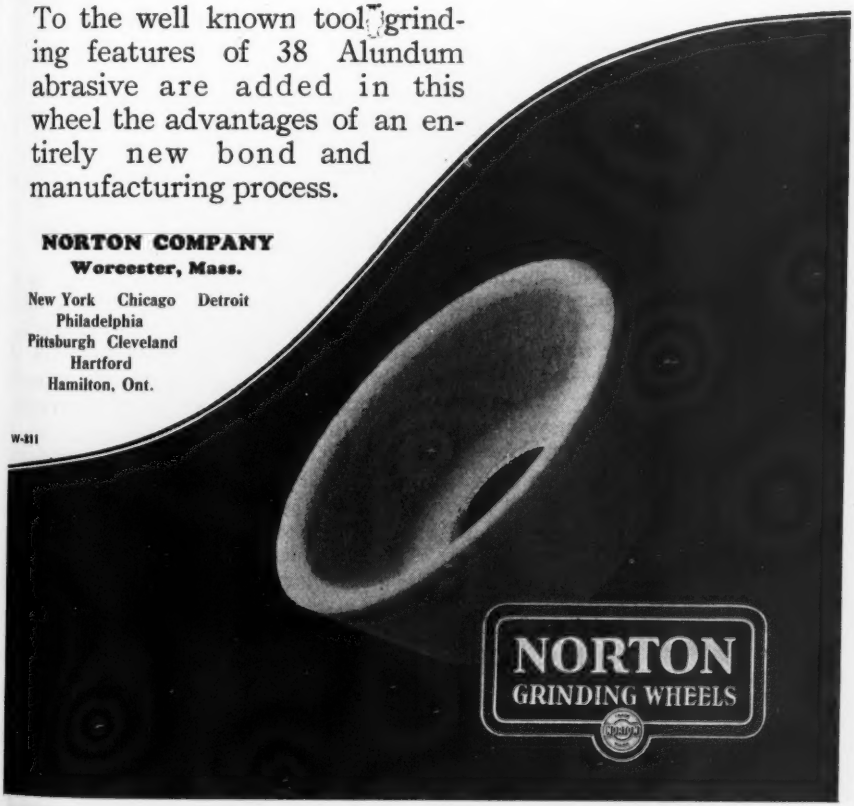


MODERN Machine Shop

Published Monthly at
128 Opera Place, Cincinnati, Ohio
By
DON G. GARDNER - - - - *Publisher*
HOWARD CAMPBELL - - - - *Editor*

This Machine Age

THINKERS have been concerned for some time past over the continuous increase in the use of labor-saving machinery and its relation to so-called "over-production," which has been credited generally with being the cause of periodical business depressions. As each new task that is given to a machine releases human labor, the question is raised as to whether an unemployment problem is thus created, and what the effect is on the national prosperity.

The shortest answer to this question is that, while America, today, has probably more labor-saving machinery than any other country on earth, American workmen work shorter hours and draw higher wages. In the face of a constant increase in the use of labor-saving machinery, the periods of "slowing up" in production recur less often and with less detrimental effect. Hours of labor have been reduced approximately 20 per cent in most industrial centers in the last two decades, and at least one large corporation has reduced the working week to five days. The use of machines for drudgery that was formerly done by hand is continually creating markets for labor of a higher-skilled and better-paid type, and labor that is released from one task by the use of machines is largely absorbed in the building of these or other machines to reduce operating costs or to increase the enjoyment of leisure and recreation time. The condition of the national payroll—which is identical with national prosperity—is reflected in the ever-rising national high standards of living.

Studying For Leisure

ABOUT a fortnight ago, 2,000 admirers gathered to do honor to nine "Pioneers of American Industry." While some of the nine might be more properly thought of as organizers and executives than as "pioneers," no one would begrudge the wealth and honors heaped upon them for great achievements. This is the roll:

Cyrus H. K. Curtis, publishing.
Glen H. Curtiss, aircraft.
George Eastman, photography.
Thomas A. Edison, invention.
Harvey S. Firestone, rubber.
Henry Ford, automobiles.
Julius Rosenwald, merchandising.
Charles M. Schwab, iron and steel.
Orville Wright, aviation.

One point is worth mentioning: Not a single one of these men had a university education. Mr. Schwab wittily referred to this fact and sounded a warning. "Many graduates come from college with an education that exceeds their intelligence," he said.

Dr. Nicholas M. Butler, president of Columbia University, rejoined with the remark that such men as the honor guests were giving the human race so many mechanical aids that the problem of the near future would be to teach men and women how to use their leisure time to best advantage, rather than to prepare them for an "occupation." In other words, the swing of the pendulum brings us back to the earlier ideal of going to college to become a cultured citizen, rather than to learn a profession.—*Iron Age.*

LEBLOND
SLIDING BED GAP LATHES

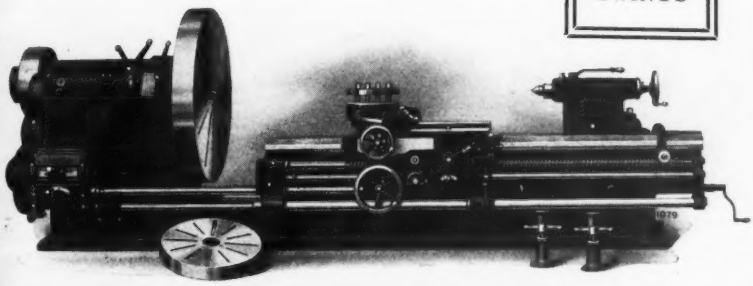
This line of lathes has been developed to meet the requirements of jobbing and service shops for a Universal Lathe of wide adjustable range. They are characterized by a sliding double bed, the top section of which is adjustable along the lower section, providing an increased swing thru the gap and variable distance between centers.

They are built with either cone driven or geared headstock or motor drive.

THE R. K. LEBLOND MACHINE TOOL CO.

CINCINNATI, OHIO

MADE IN SIZES
19″—38″
25″—50″
33″—60″
SWINGS



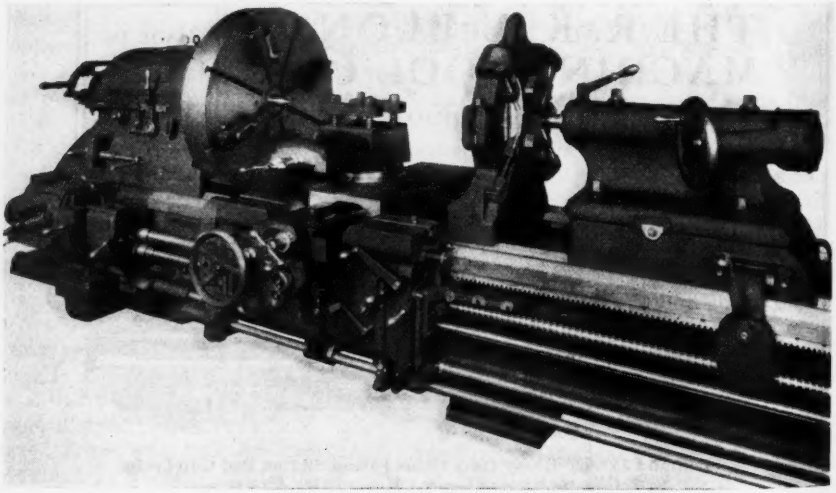
LeBlond 33″-60″ Heavy Duty Geared Head Sliding Bed Gap Lathe with Constant Speed Geared Motor Drive Arrangement.

New Shop Equipment

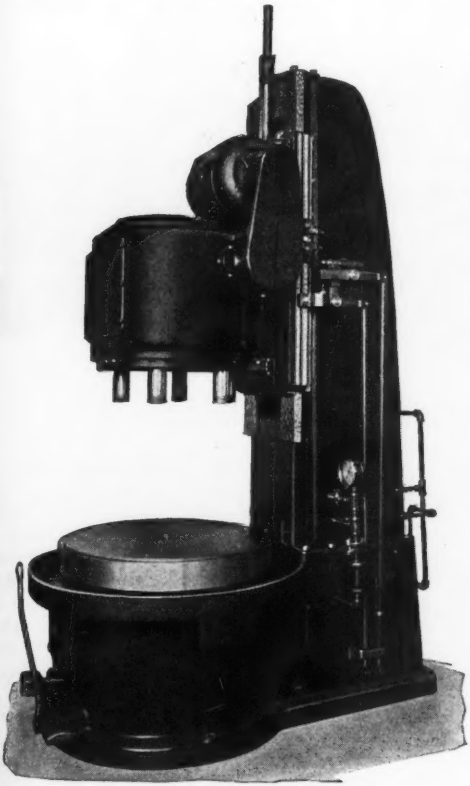
Bradford 48-Inch "Lowdrive" All-Geared Lathe

Made from new patterns throughout, widely different in design, and comprising entirely new lathe mechanisms, the illustration shows the 48-inch "Lowdrive" all-geared lathe which has been placed on the market by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The cardinal feature of the machine is the all-geared transmission, which is of extraordinary weight and strength. About two-thirds of the "all-geared" drive is located entirely under the head and down in the bed, where the six selective initial speed changes are controlled and locked by a single selective speed change lever. Power is delivered from these speed gears through a heavy flexible chain up to the initial drive in the lower front part of the head. The pull-down on the chain, which is increased with heavier cuts, is a big factor in securing extraordinary rigidity between the head and the bed.

The head itself carries, in addition to the spindle, a back gear drive and a triple or face plate drive as well as the direct drive for the spindle. It also contains a "tumbler" for the feeds and threads as well as a mechanism having two coarse screw ratios, thus increasing the thread and feed range. Threads from 1 to 56 and feeds from 2 to 112 per inch are available. The spindle speeds include 18 forward and reverse, ranging from 1½ to 175 r.



Bradford 48-Inch "Lowdrive" All-Geared Motor-Driven Lathe.



BARNES

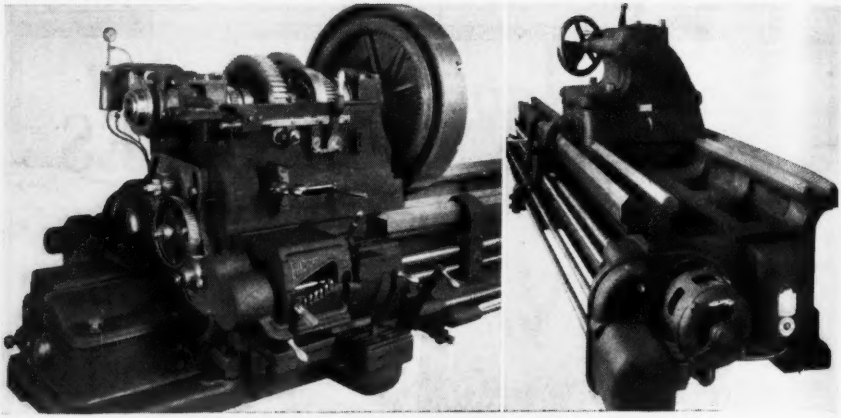
HEAVY DUTY VERTICAL OIL GEAR FEED DRILLING MACHINE with PLAIN or ROTATING TABLE

Write us about your Drilling Problems

W. F. and JOHN BARNES CO.

ROCKFORD, ILLINOIS

Upright Drills **Screw Presses**
Horizontal and Vertical Production Drilling and Boring Machines



(Left) Headstock With Guards Removed. (Right) Tail End of Lathe showing Rapid Traverse and Pawl Rack for Tailstock.

p. m. A spindle brake acts automatically when the drive to the spindle is disengaged between the direct and back gear drives.

The engagement of all sliding gears and tumbler gears is controlled through a mechanism which prevents the shifting of these gears under load, thus precluding the possibility of damage to the machine. The face plate drive is controlled by a single shift of a large lever which slides the pinion in or out of mesh with the face plate gear. With this drive engaged, the apron control is used to start, stop or reverse the lathe spindle. Power rapid traverse is available for quick movement of the carriage, and is also available to operate the carriage cross feed screw and toolrest as well as the angular feed to the compound rest.

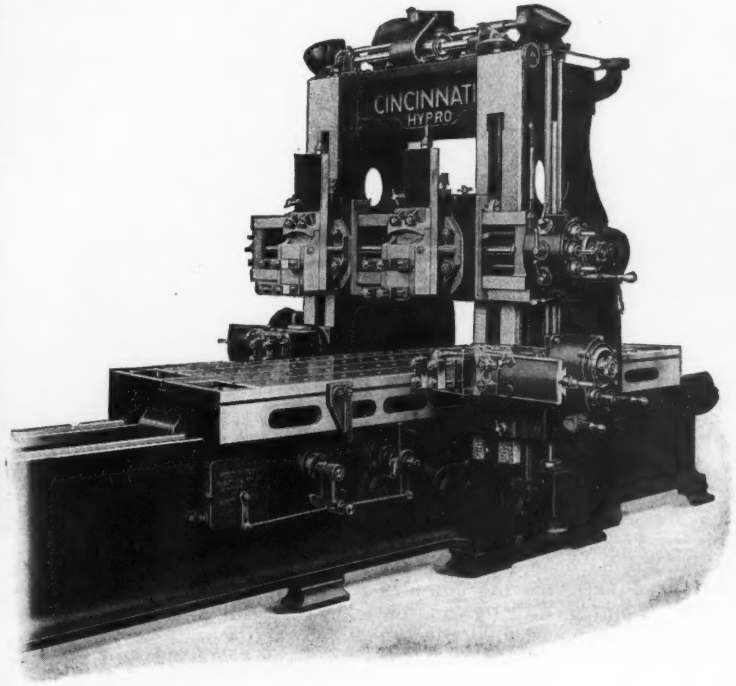
The lead screw is $2\frac{7}{16}$ inches diameter, with 1 thread per inch. The tapered spindle bearings are made from a special hard phosphor bronze alloy, and are hand-scraped. The spindle journals are ground, fitted and tested. Bearing adjustment is obtained by means of two collar nuts which are easily accessible. A large ball thrust bearing receives the spindle end thrust. The independent starting, stopping and reversing mechanism is controlled by a lever at the carriage, upon which all other controls are also located. The power rapid traverse can only be engaged when the normal power feed is disengaged, and the feed rod cannot function unless the lead screw is disengaged. The chasing dial, also located at the carriage, can be swung to inoperative position when not threading. The tailstock is provided with a forwardly-located handwheel which allows the operator to center work or perform boring operations with a minimum of effort. A powerful tailstock conveyor is also provided.

The lathe is usually furnished with a 25 h. p. constant speed motor which runs continuously in one direction only, the reversing, speed-changing and reversing mechanism being independent. The motor is controlled by a push button at the lathe head, or at any place required by the user. A powerfully-built steadyrest with 18½-inch adjustable jaws is standard equipment and a "Bradford-Type" taper attachment can be supplied if desired.

"Mil-Waukee-Mil Broadside"

A heavy duty milling machine that is intended for use in machining the

CINCINNATI HYPRO-PLANER

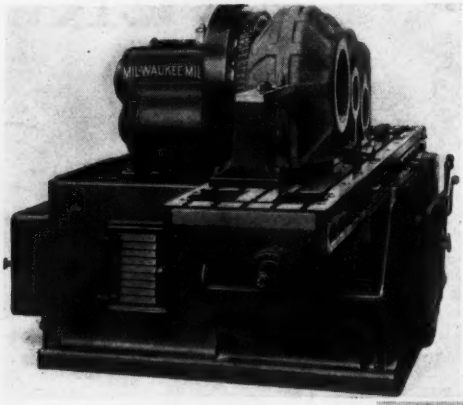


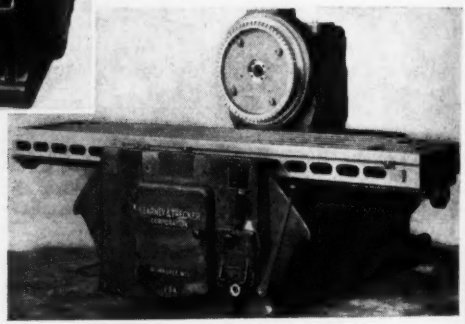
Selective Dial Feed, Instantaneous Rail Lift Rail Clamp, Rapid Traverse and Forced Lubrication are a few of the Leading Features

THE CINCINNATI PLANER CO.

222 SOUTH STREET CINCINNATI, OHIO

faces of heavy castings, side frames, cylinder blocks, and other similar work, and known as the Mil-Waukee-Mil Broadside, has been placed on the market by the Kearney & Trecker





(Above) "Mil-Waukee-Mil Broadside" in operation. (Right) Front View of Machine.

Corporation, Milwaukee, Wisconsin. The foundation of this machine is the same as the Mil-Waukee-Mil Simplex or Duplex, the special milling head replacing the standard head used on the Simplex and being mounted directly on the bed. Two of these special heads can be used to replace the standard heads on the Duplex, or one special head and one standard head can be used.

The maximum diameter of cutter useable on the Broadside is 24 inches, the larger cutters being driven by clutch keyways with the cutters held to the faceplate by means of bolts. The entire head is automatically lubricated and Timken bearings are used throughout. The spindle is 5⅜ inches diameter. The front Timken bearing is 8½ inches diameter and the rear bearing is 6 inches. The drive to the faceplate is through a pinion which meshes with a 20½-inch 4 P. gear on the back of the faceplate. The driving pinion shaft is supplemented by a free-running shaft, both shafts carrying flywheels, thus obtaining the effect of a counterbalanced drive. The momentum of the drive shaft flywheel prevents the cutter from "kicking back" as each tooth bites into the metal, and the auxiliary shaft flywheel prevents the cutter from "jumping ahead" as the tooth leaves the metal. Thus a smooth flow of power is obtained.

The Broadside head is equipped with pick-off gears, providing 12 spindle speeds which range from 6 to 51 r. p. m. A range of 18 feed changes is also available through either pick-off gears or a quick change gear box. The Broadside can be furnished with either a 14-inch or 22-inch table, as required. The machine has capacity for a 15 h. p. motor.

Walden Cam Vise

A vise which centers and clamps the work at one movement of a lever, and which can be adapted to handle all kinds of irregular-shaped pieces, has been marketed by Fritz Uhlenhaut, 200 Congress Street, Boston, Mass. The vise—known as the Walden Cam Vise—can be used with any kind of machine, or for assembling where irregular-shaped parts must be fitted quickly. The movement of the lever imparts a positive movement to the jaws, opening or closing the jaws and centering the work at one move-

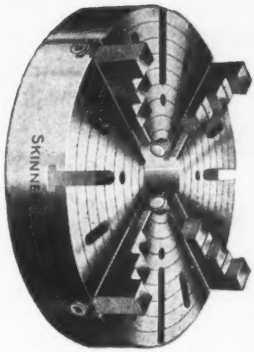
Skinner Lathe Chucks

SKINNER CHUCKS

DEPENDABLE AS TIME

THE SKINNER 4-JAW

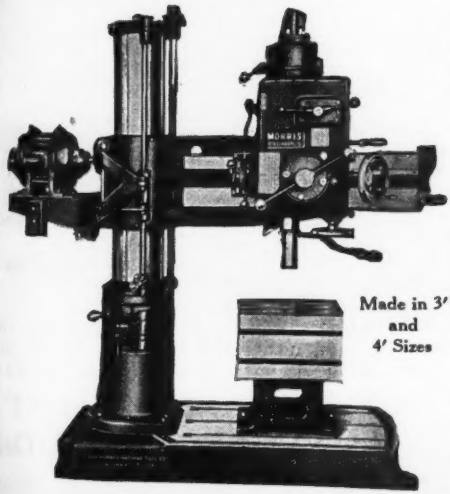
Independent Chuck, either iron or steel body, should be part of the equipment of every lathe.
The body is a well proportioned high-grade casting.
All movable parts are of special alloy steel, properly heat-treated.
Made in all the popular sizes.



May We Send You Our Complete Catalog

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN., U. S. A.

"MOR-SPEED"—Named for a Purpose



Made in 3′ and 4′ Sizes

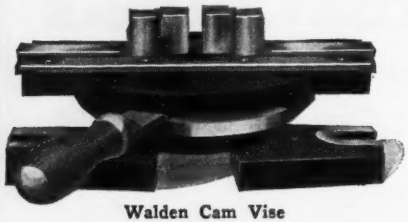
Morris Mor-Speed Radials are so named to drive home the fact that they are powerful, efficient, *fast!* They are production machines and are built to give service.

Timken Roller Bearings; all geared drive with hardened gears—six broached keyways; heat treated shafts, multiple splined; multiple disc clutch; forced feed lubrication; all speed and feed changes in the head; single lever elevating and clamping—just a few of the features that "make" Mor-Speed Drills. Spindle speeds from 100 to 1600 R.P.M.; capacity to 1½" drills; sizes 3′ and 4′.

Send for complete details.

THE MORRIS MACHINE TOOL CO.
CINCINNATI, OHIO, U. S. A.

ment. Each piece requires a set of jaws, made to conform to the piece,

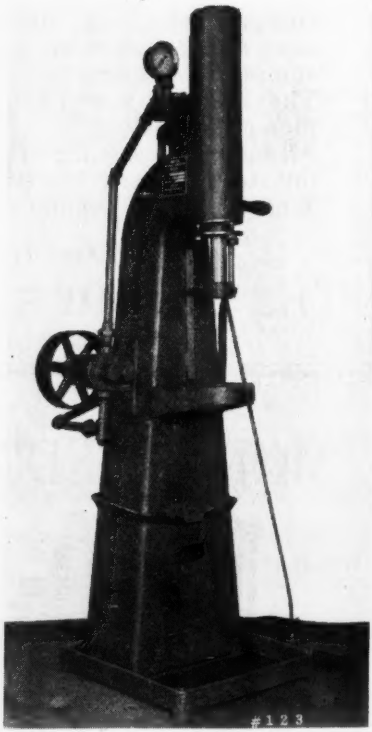


Walden Cam Vise

but a Walden Cam Vise so equipped serves, in many cases, to take the place of an expensive jig or fixture, and the one-stroke operation is the simplest possible. As the jaws open, on the backstroke, the jaws spread and the piece can drop through into a receptacle or can be removed by hand in the usual manner. Variations in the castings cause little trouble because the jaws center the piece. The vise is strong, rigid and well balanced, and all parts are interchangeable. All operating parts are hardened and ground. The vise is made in three sizes.

"American" 2-Ton Vertical Broaching Press

To meet the demand for an ideal machine for broaching connecting rods, gears, and other work of this class, the American Broach & Machine Co., Ann Arbor, Michigan, has developed the machine shown in the illustration. The machine is hydraulic, of the vertical type, and can be furnished for belt drive or complete with motor for motor drive, as required. The capacity of the machine is two tons, maximum stroke, 14½ inches, and the ram speed is 14 feet per minute at a pump speed of 600 r. p. m. This speed can be changed by changing the speed of the drive shaft. The ram returns to top position automatically at the completion of the downward stroke, and the stops are adjustable to any stroke up to the maximum. The ram is 2 inches in diameter, and is tapped ¾-16 U. S. S. thread in the end. The work table top is finished, is 8 inches diameter, and the opening in the table is 2¾ inches in diameter. The offset of the upright permits handling of work up to 10¼ inches diameter. A lubricating pump with oil receptacle can be supplied if desired. When motor-driven, the drive is through a Link-Belt chain and



"American" 2-Ton Vertical Hydraulic Broaching Press

sprocket. The machine can be furnished either for use as a bench machine, or with a pedestal as shown.

"U. S." ¾-Inch H. D. Drill

The illustration shows a ¾-inch heavy duty electric drill that has been

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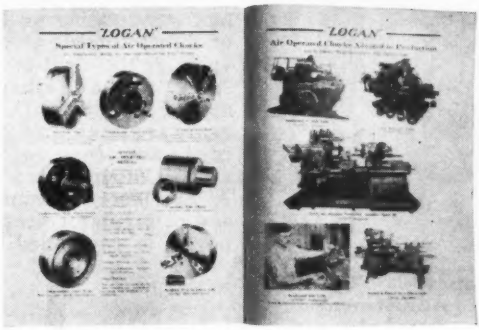
Presses
Clamps
Jigs
Work Ejectors



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Save Labor
Save Overhead
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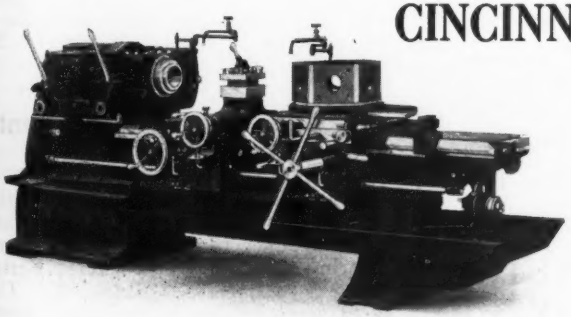
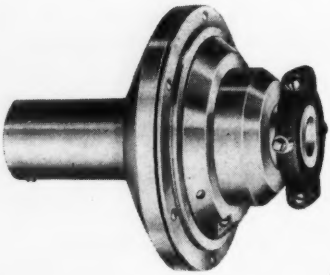


17″ and 4½″
Universal
Duo Control
Turret
Lathe

THE ACME MACHINE TOOL COMPANY
CINCINNATI, OHIO



A— Appearance
Accurate Adjustment

C— Capacity
Centripetal Action

E— Enclosure
Easy Engagement

H— Hardened Forged Levers
Hardened Steel Contact

I — Instant Release

G— Gradual Pickup

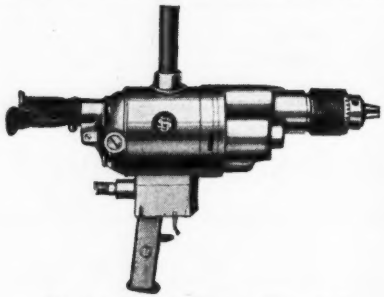
H— Helped, not hindered, by centrifugal force in idling.

THE
CONWAY CLUTCH
COMPANY

1959 WEST SIXTH STREET

CINCINNATI, OHIO

brought out by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. The drill is unusually powerful for a drill of this size, is of the low-speed type, and is intended for use where the service is hard and continuous. A universal motor, operating on either alternating or direct current at 60 cycles or less, operates this drill at 350 r. p. m., load speed. In all other respects, it is similar to other U. S. drills. The gears are of chrome nickel steel, hardened, and running in grease. The shaft is mounted in SKF ball bearings. A one-piece, aluminum body frame and commutator head is used, and the power is controlled through a quick



"U. S." ¾-Inch Heavy Duty Drill

make, quick break, two-pole trigger switch. A three-jaw screw back chuck is supplied. The drill weighs 27 pounds.

Flexible Tooth Steel Silent Gear

An all-steel silent gear, called the "Double-D Steel Silent Gear," has been produced by the Flexible Engineering Corporation, 10 East Forty-third Street, New York, N. Y. The gear combines the strength and wearing qualities of steel with non-metallic silence, through the principle of mechanically flexible teeth. Built up of hundreds of thin, graphited steel laminations, it is so constructed that the teeth flex slightly under impact, cushioning the noise without deform-

DESIGNERS AND BUILDERS OF SPECIAL EQUIPMENT AND MACHINERY

AVERBECK SHAPERS

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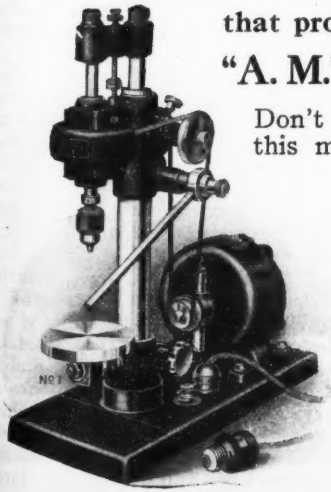
GEARS

The Steel Products Engineering Co.

SPRINGFIELD, OHIO

Where Small Drilling Is a Problem—



that problem can best be solved with an

"A. M." Sensitive Drilling Machine

Don't take our word for it! We will send this machine to any responsible firm for

10-days free trial!

Send blueprint or sample so that we can determine size of machine desired. If not adaptable to the work, it may be returned at our expense.

No toolroom is complete without an "A.M." Sensitive Drilling Machine. Soon pays for itself on fine drilling work. Ask us for "An Outline of Economical Small Drilling."

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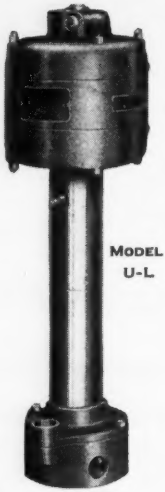
Fifth and Elm Sts., S. E., Cincinnati, O.

GUSHER
Coolant Pumps



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High Speed Production

where *reliability* and *efficiency* are absolutely essential.

Write today for complete information

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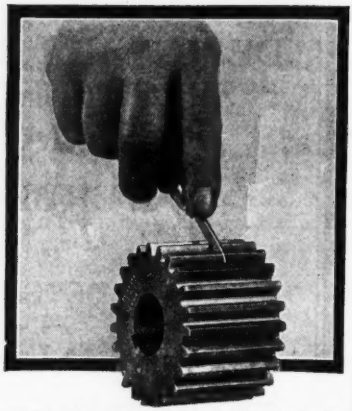
Front and Pike Streets
CINCINNATI

ing the tooth profile at the pitch line. The gear machines easily and is cut



Illustrating Principle of Mechanically Flexible Teeth

with backing plates. It is supplied in either blank or cut form.

"Hisey" Combination Disc and Floor Stand Grinder

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has brought out a 3½-h. p. Combination Disc and Floor Stand Grinder, shown in the illustration herewith. The spindle of this machine is made of a special grade of tough steel, and is of extra heavy construction, insuring permanent concentricity of the disc. The spindle is mounted on two high-grade annular ball bearings, which take radial load only. A double-acting, self-aligning thrust bearing takes all end thrust.

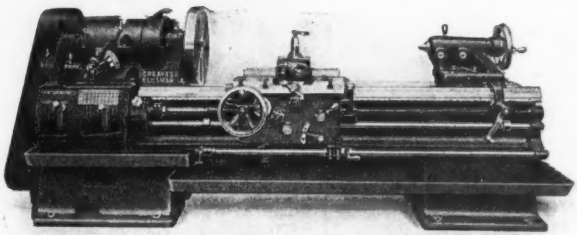
The machine is shown with a plain, 8¼ x 9½-inch work table, which is furnished as standard equipment, but a universal level-feed table, 6½ x 13 inches can be supplied if desired. The disc is 15 inches diameter, and the grinding wheel is 14 x 2½ inches diameter. The spindle is 31½ inches long, and runs at a no-load speed of 1,725 r. p. m. The height from floor to center of spindle is 35 inches. Standard equipment includes steel

If you designed a lathe—

FOR PRODUCTION, MAINTENANCE OR JOBBING WORK

—what more would you have?

Flexible Motor Drive



Single Lever Control

THE G-K HEAVY DUTY ENGINE LATHE HAS

Bed reinforced by extra heavy ribbing extending the full length of the bed.

Chilled ways, providing for longer life and increased accuracy.

Forged steel spindle, turned from solid block of high carbon steel.

Drop-forged steel gears throughout. Transmission gears are heat-treated.

Extra heavy headstock, with internal bracing both lengthwise and crosswise. Anchored for permanent alignment.

ASK FOR DESCRIPTIVE CATALOG

THE GREAVES-KLUSMAN TOOL CO., Cincinnati, O.

STEEL FORGINGS

WeldLESS Rings

WeldLESS rings are among the forgings we make — other products are spindles, gear blanks, hooks — an endless variety of forgings, each suited to its task.

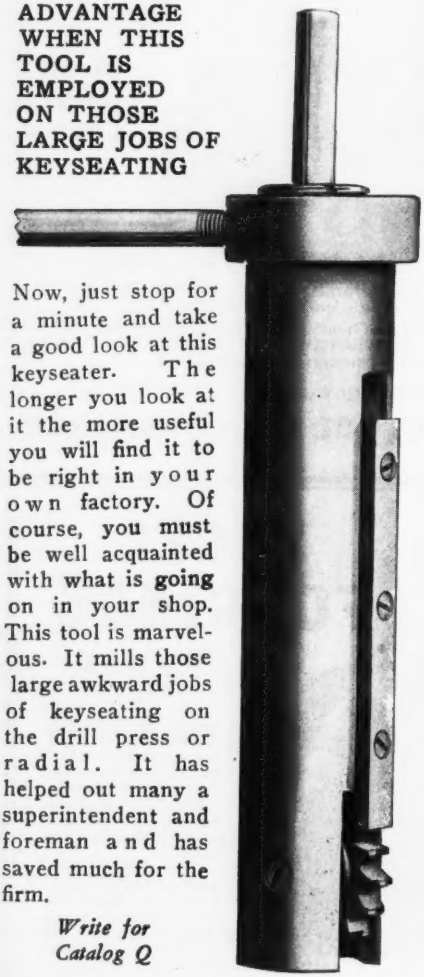
The correct steel and a skillful touch here and there are the points that put Steel Forgings in the preferred class.

Your specifications will receive prompt attention.

THE STEEL FORGINGS CO. Cincinnati, Ohio

ADVANTAGE DERIVED

AND A GREAT ADVANTAGE WHEN THIS TOOL IS EMPLOYED ON THOSE LARGE JOBS OF KEYSEATING

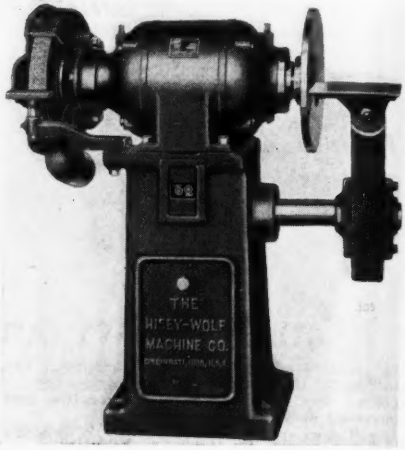


Now, just stop for a minute and take a good look at this keyseater. The longer you look at it the more useful you will find it to be right in your own factory. Of course, you must be well acquainted with what is going on in your shop. This tool is marvelous. It mills those large awkward jobs of keyseating on the drill press or radial. It has helped out many a superintendent and foreman and has saved much for the firm.

Write for Catalog Q

NATIONAL MACHINE TOOL CO.
2271 Spring Grove Avenue
CINCINNATI, OHIO

disc, plain work table, safety combination wheel guard (as shown), automatic safety motor starter and con-

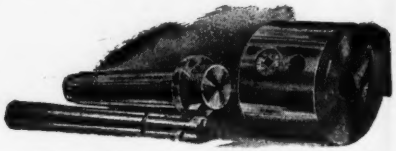


"Hisey" Combination Disc and Floor Stand Grinder

necting wires. The grinding wheel is furnished to order only. The machine is furnished for either 220 or 440 volts A. C., or 115 or 230 volts, D. C. It can be furnished for special voltages if required.

Flynn Micrometer Offset Boring Head

A boring head which is especially adapted for use for jig and fixture work, metal pattern making, machining core boxes, and for other similar

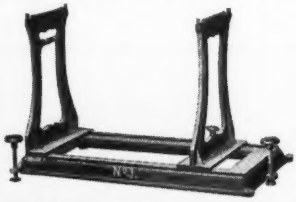


Flynn Micrometer Offset Boring Head

work, has been brought out by J. M. Waterston, 327 Woodward Ave., Detroit, Michigan. The tool is graduated in thousands of an inch, and has an

For Sure Balance—

an absolutely level and solid "Way" is necessary



BOWSHER "Balancing Ways"

are brought to an absolute *level* in ten seconds. No revolving parts.

The edges or "knives" upon which the work is tested are ground *true*, and are mounted upon the planed "ways" of a heavy bed or frame.

Standards adjustable to suit length of arbor.

Three sizes for floor—one for bench use

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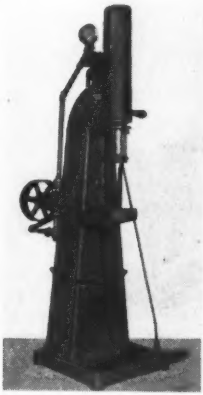
The N. P. Bowsher Co., South Bend, Ind.

BROACH *for* *Accuracy—Economy!*



Let us show you how to finish more holes—more accurately—and at less cost.

The American 2-Ton Hydraulic Press

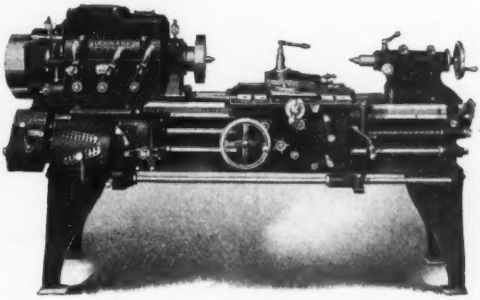
is recommended for broaching connecting rods and work that comes within the 2-ton range. We manufacture presses from 2 tons to 150 tons pressure, also all types of broaching tools.

AMERICAN BROACH & MACHINE CO.
ANN ARBOR, MICHIGAN

"Lehmann Lathes"

TWO STYLES
Three Step Cone and 16-Speed Geared Head

5 SIZES
16/18¼"
18/20¼"
20/22"
22/24¼"
24/27⅛"



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the most modern ideas in design and construction. Their performance is their best indorsement.

Ask Any User

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Multiple Units

From Single Drills

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

The United States Drill Head Co.

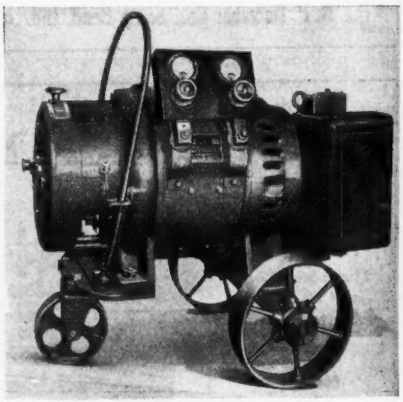
1954 Riverside Drive

Cincinnati, O., U. S. A.

offset of 1¼ inches. It will take drills or tool shanks of from ¼-inch to ¾-inch in diameter. The boring bar is held in position by a lock screw against the V in the hardened steel cross head. The body of the tool is 4 inches diameter by 3 inches long, and weighs 6½ pounds. Any type of shank can be supplied, as required by the type of machine in which the tool is to be used. A ¾ x 5½ inch boring bar can also be supplied if desired.

Fuzon Arc Welder

The illustration herewith shows the portable type of 200-ampere motor-generator arc welder now being made by the Fusion Welding Corporation, 103rd and Torrence Avenue, Chicago, Ill. The machine incorporates a number of new features that will interest the welder, one of which is the elim-



200-Ampere Fuzon Arc Welder.

ination of the use of external stabilizers by the use of an ingenious method of interpole arrangement. The turns of the commutating coils are extended to and completely imbedded in the adjacent main pole flanges, the commutating windings which are thus surrounded by laminations functioning

Champion Portable Tool Stand

Take Tools, Vise and Bench to the Work, Not the Work to the Bench

Made strong enough to carry any load; easily moved anywhere. Keeps tools and work together.

It is the greatest kind of time saver, and hence a daily economy in every shop.

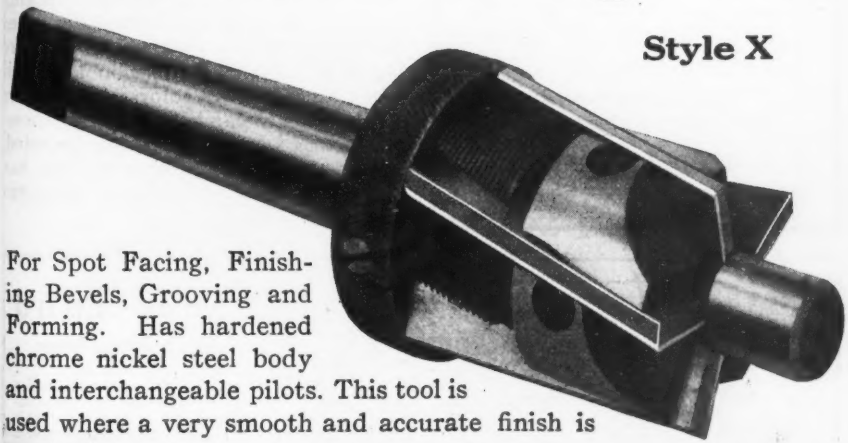
When handle is upright as shown, the bench rests solidly and immovably on the floor; when handle is pulled forward, it throws the front wheel into operation and releases the brake from the rear wheels.

Catalog upon request

***The* WESTERN TOOL & MANUFACTURING CO.**
SPRINGFIELD, OHIO

Genesee Facing Tool

Style X



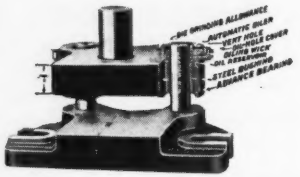
For Spot Facing, Finishing Bevels, Grooving and Forming. Has hardened chrome nickel steel body and interchangeable pilots. This tool is used where a very smooth and accurate finish is required.

GENESEE MANUFACTURING CO., Inc.
Established 1908 **Rochester, New York**

as an excellent stabilizer. Field excitation is provided through the medium of an auxiliary set of brushes on the main commutator, which makes possible single control.

The welder is designed to make it easy for the operator to hold the medium short arc length. The stabilizing windings compensate instantaneously for the changes in arc length, caused by electrode metal leaving the rod, no manipulation being required to keep the arc going. The Fuzon Welder is designed and constructed to give satisfactory service over a period of years. The shaft, which is comparatively heavy, is supported by two ball bearings at each end. The commutator is larger in diameter than usual. A fan, which is built into the machine, keeps the machine cool and it can therefore be run beyond its rated capacity for hours without running hot. The Fuzon motor driven generator is furnished portable or stationary in 200, 300 and 400-ampere capacities. Fuzon gas engine driven generators are furnished in 200 and 300-ampere capacities, and the generator can be furnished separately for belt drive or for connection with a gas engine.

BAUMBACH
Automatically Oiled
DIE SETS



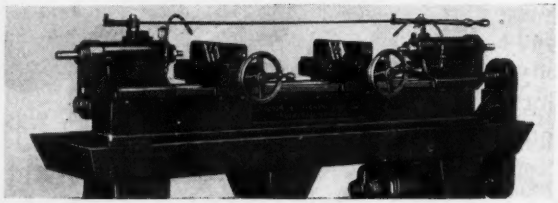
Standardized die sets, embodying many exclusive features, and a listing of 70,000 stock sizes afford a service that is unsurpassed.

Your Inquiries Solicited
Send for New 120 Page Catalog

E. A. Baumbach Mfg. Co.
1806 S. Kilbourne Ave. Chicago, Ill.

Oesterlein Miller Catalog

The advantages of the Tilted Offset Miller are set forth in a catalog which has been issued by The Oesterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. The catalog contains 20 pages, 8½ x 11 inches, and describes both the 28-inch and 48-inch millers made by this firm. The book is well illustrated in two colors, both views of the machine and illustrations showing actual applications being included. Figures as to the production that has been obtained with these machines are also given.



Sundstrand
Double End Centering Machine

For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accommodates a wide variety of work. Special fixtures furnished when desired. Send for Bulletin.

SUNDSTRAND MACHINE TOOL CO. **Rockford, Illinois**

"HOPKINS" PREFERRED EQUIPMENT

Series "C" Double-Acting

AIR CYLINDER

Great Improvements!

Newly developed, the "HOPKINS" Series "C" Double-Acting Air Cylinders embody unusual improvements which are perfected to operate chucking equipment — *at low cost.*

This cylinder operates by handle with a connecting rod attached to the distributor. Air valve and two pipe line connections are discarded.

The new box pistons use every bit of air, dead air space being eliminated. The total number of packings, reduced to 5, are automatically sealed by compressed air. Adjustable packing glands are eliminated.

The "HOPKINS" Cylinder "C" admits no superior! Learn more about it!

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THE TOMKINS-JOHNSON CO.
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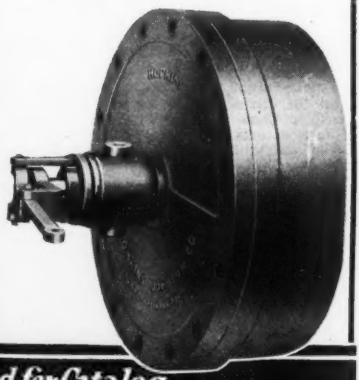
Also Manufacturers of Chucks, Die Sinking Milling Cutters, Etc.



Send for Catalog

Here is a New Jig

That Clamps and Centers With ONE Stroke!

It means a real saving in costs—and an increase in production.

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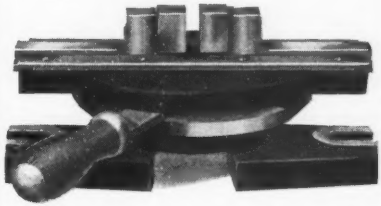

There's no piece that comes within the capacity of the Walden Cam Vises, which means anything from three inches down, that cannot be drilled, reamed, milled, tapped, sawed, slotted, bored, threaded or machined quicker, cheaper and better on a spindle machine using a Walden Cam Vise than in any other way.

Nothing on the market even approximates the Walden Cam Vise in design, action or results.

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Thirty days' free trial! We will be glad to send a Walden Cam Vise to any rated concern on thirty days' free trial. Put it to every test you wish, on as many jobs as possible. If you do not consider it worth twice the price, send it back. No obligation. You will be the judge and jury.

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For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Turret Lathes and Tools: Illustrated book describing Cincinnati Acme Turret Lathes and Screw Machines, and showing a variety of tools and fixtures for use with these machines. The Acme Machine Tool Co., 4955 Spring Grove Ave., Cincinnati, Ohio.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Bowsher Balancing Way: Gears, pulleys, fly-wheels, emery wheels, and other rotating parts should be properly balanced. This work can be done quickly and accurately on a balancing way that is described in a bulletin issued by The N. P. Bowsher Co., South Bend, Indiana.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

Gears of All Kinds are described and illustrated, with specifications, in Catalog 80 which has been issued by the Chicago Stock Gear Works, 105-9 S. Jefferson St., Chicago, Ill. Copy sent free on request.

Drilling Machinery: Circulars describing all types and sizes of radials, uprights, and gang drills for every class of work may be had by writing to The Cincinnati Bickford Tool Co., Oakwood, Cincinnati, Ohio.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

"The Lathe With the Pull" is the title of a catalog that has been published by the Cisco Machine Tool Co., 1765 Elmore St., Cincinnati, Ohio. The book describes the engine lathes, polishing lathes, and radial drill presses made by this firm.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Disc, Expansion and Compression Clutches: The various types of clutches and their uses are discussed in an illustrated booklet that is issued by The Conway Clutch Co., 1959 West Sixth Street, Cincinnati, Ohio.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin St., Detroit, Michigan, describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Silent Gears of Steel: Gears built up of thin steel laminations so that the teeth flex under impact, thus cushioning the shock, are described in Circular G-6, issued by the Flexible Engineering Corporation, 10 East 43rd St., New York, N. Y.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Machinists' Tool Cases and Chests: The high grade tool cases and tool chests manufactured by H. Gerstner & Sons, 1254 Columbia St., Dayton, Ohio, are described in detail in catalog No. 27, which can be had by writing to this company.

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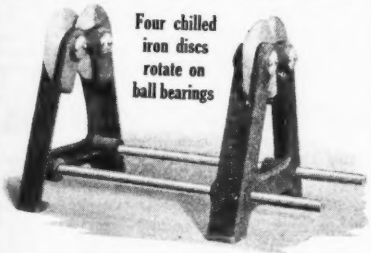
Balancing Ways

No Leveling Required

A simple and excellent device for balancing, straightening and trueing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000



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An economical tool for back spot-facing inaccessible surfaces. Drive is accomplished through two parallel keys which are integral parts of lower end of cutter—providing a balanced drive. Practically entire cutter may be used up as drive is at extreme opposite end from cutting teeth.

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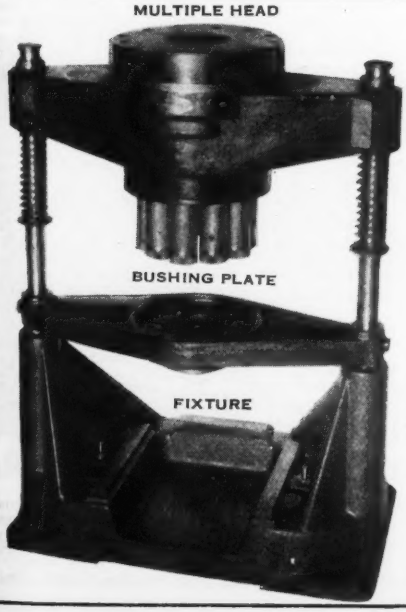

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Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Vises and Pipe Tools: The bench, machine and pipe vises, pipe cutting and threading tools, babbitt ladles and melting pots made by the Hollands Manufacturing Co., Erie, Penna., are described and illustrated in a booklet that is issued free by the firm mentioned.

Modern Milling Equipment: A book describing and illustrating in detail all the parts of various types of milling machines and showing a number of ways of handling milling jobs will be sent free to the readers of this magazine by the Kearney & Trecker Corporation, Milwaukee, Wis.

Standardized Jigs and Fixtures: Information concerning standardized jigs and fixtures, also all kinds of special equipment for production, can be had by writing to H. R. Krueger & Co., 439 East Fort St., Detroit, Mich.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Lehmann Lathes: Details of the outstanding features of Lehmann Lathes are given in a catalog published by the Lehmann Machine Co., 3560 Chouteau Ave., St. Louis.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Lamp Guards: The various types and kinds of lamp guards made by the McGill Manufacturing Co., Valparaiso, Ind., for factory use are described in a catalog that will be sent free upon request.

Roller Bearing Radial Drills: The application of Timken roller bearings in the design of modern radial drilling machines is discussed in a bulletin describing "Mor"-Speed Radial Drills, published by the Morris Machine Tool Co., Cincinnati, Ohio.

An Outline of Economical Small Drilling: The subject of small-hole drilling is discussed in a booklet that is published by Adolph Muehlmatt, Fifth and Elm Sts., S. E., Cincinnati, Ohio The booklet also describes the outstanding features in the construction of the A. M. Sensitive Drilling Machine.

"The 'Hole' Story In One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natco" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

"Tool Room Grinding" tells how to sharpen milling cutters and how to grind drills, taps, reamers, lathe and planer tools, and dies. A number of drawings and photographs are shown, showing how to hold the tools for grinding, and the kinds of chips that should be produced by properly-ground tools, etc. Published by Norton Co., Worcester, Mass.

Grinding Wheel Information: A booklet which tells how grinding wheels are made and graded, and which give instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

Correct Cutter Grinding: How cutter costs can be reduced and more production per grind of cutter obtained is told in Booklet "E," published by The Oesterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. Sent free upon request.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

"Chucks and Their Uses" is the name of a book which contains a full description of the different kinds of chucks and suggestions for the proper care of chucks, and tells how chucks should be fitted to lathes. It also contains a number of suggestions for general shop practice. Sent free upon application by The Skinner Chuck Co., New Britain, Conn.

Material-Handling by Modern Methods: Modern methods of storing and transporting materials in the shop are discussed in a bulletin which also describes the various types of lift trucks manufactured by The Stuebing Cowan Company, 320 East Court St., Cincinnati, Ohio. Sent free upon request.

Twentieth Century Balancing Tools: A practical, sensitive and inexpensive device for balancing pulleys, flywheels, and other round parts is described and illustrated in a bulletin that will be sent without charge by the Sundstrand Machine Tool Co., Rockford, Ill.

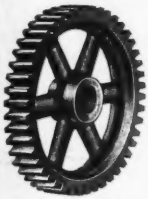
Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Walden Cam Vise: A vise that centers and clamps the work with one stroke of a hand lever, and which can be used as a quick-action jig for pieces of any shape, is described in a circular that will be sent free by Fritz Uhlenhaut, 200 Congress St., Boston, Mass.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vises, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.



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Get one for yourself—it will save money on your tools, and time on your jobs. Free catalog shows many sizes and styles.

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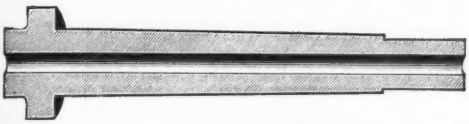

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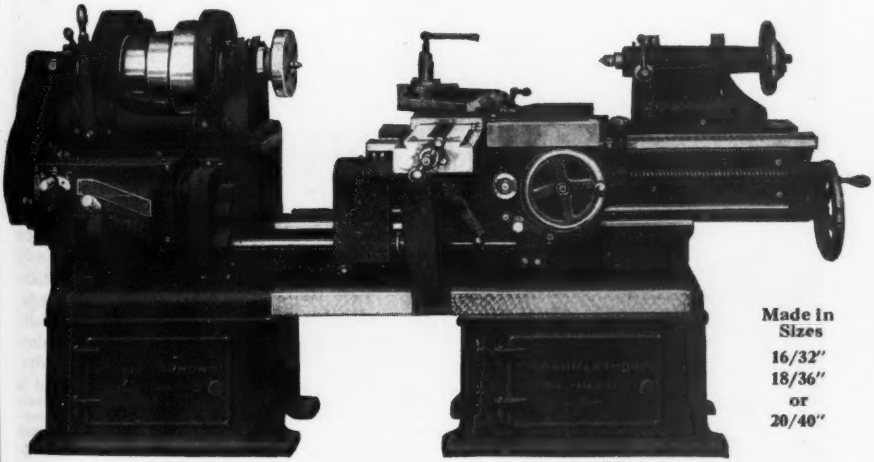

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A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

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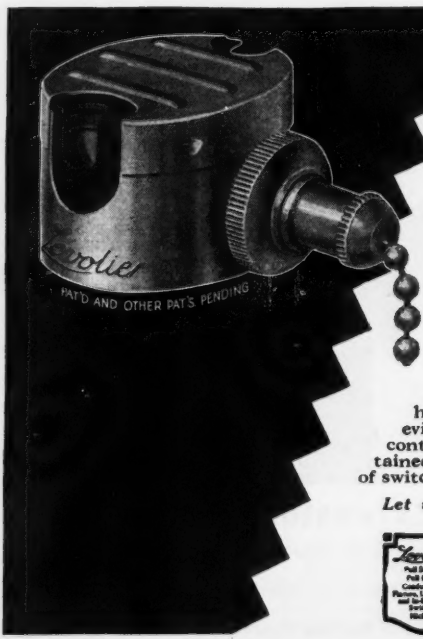

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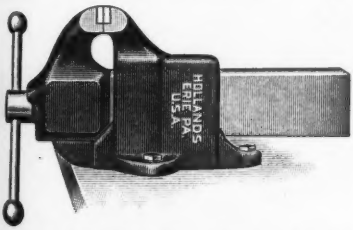

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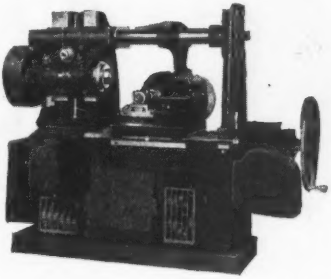

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By GEO. ALEXANDER MANN
Raver-in-Chief

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Paw says "The vets of war have got it on the vets of matrimony—they get a pension."

Got Plenty Now

"I didn't have no time."
The poor simp speedster brays,
An' so the judge proceeds
To give him thirty days.

Hot Come-Back

"The bread and cakes that mother made,
I find that you make neither;"
She said, "Yes, and you don't make
The rolls that dad did, either."

Can You Beat Ut?

The ideas wimmin have of skirts
These days sure make me snort.
Mother says that daughter dear's
Too young to wear 'em short—

Don't be too hard on the cops—they have to pinch to get along—

Many Times It's Where You Find The Sign "No HELP WANTED" That The Most Help Is Needed—

One o' the biggest blows to any lawyer is to find out that the man he defended was really innocent—

The biggest difficulty is for half of the world to understand why the other half is permitted to live—

GIVE HIM WHAT HE DESERVES

An Indiana statesman says "The farmer deserves a place in the sun"—sure, Myrt—Take his Cadillac sedan from him an' let him ride in a Fliv with the top down—

It isn't a very pretty word, and even Gene Tunney would bar it, but nevertheless it never got a business man anywhere to "belliache" when the situation calls for brains, initiative and action.

Poor Sap

Brot his umbrella,
Poor Dumb-bell Artie,
Somebody told him
'Twas a wet party—

Ain't Ut Pitiful

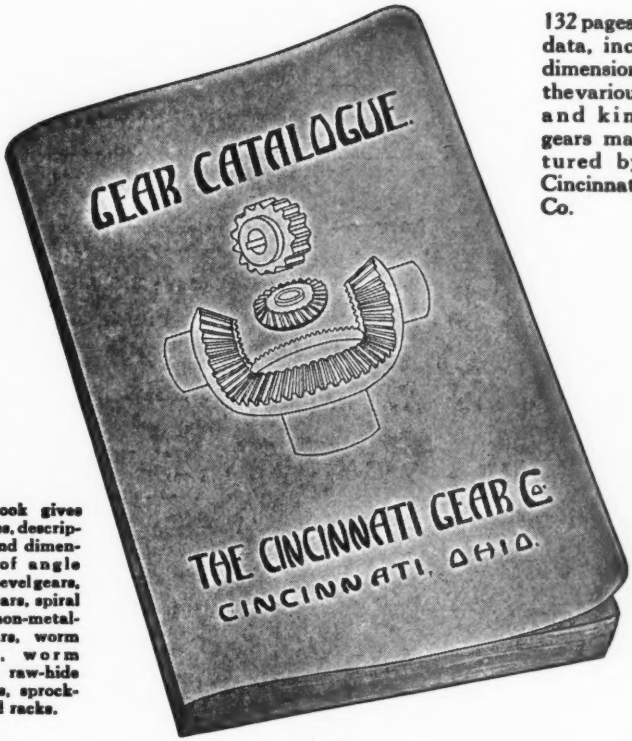
The diff between my shoes an' me,
As thro this life we live
Is that I give until it hurts,
An' they hurt till they give—

The installment man gets rich by paying cash for his goods.

The average husband is proof enough that when a woman is love-sick she'll take any ol' kind o' pill—

This Catalog Free—

to any machine shop executive!



132 pages of gear data, including dimensions of all the various types and kinds of gears manufactured by The Cincinnati Gear Co.

The book gives the sizes, descriptions and dimensions of angle gears, bevel gears, spur gears, spiral gears, non-metallic gears, worm gears, worm wheels, raw-hide pinions, sprockets, and racks.

All Kinds of Information For Users of Gears

is also included, such as tables showing horsepower of various kinds of gears, proportions of various types of gears, rules for ordering gears, metric conversion table, comparative sizes of gear teeth, table for calculating speeds of pulleys, etc.

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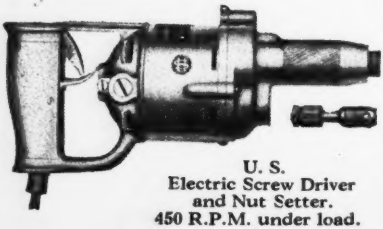
THE CINCINNATI GEAR CO.

CINCINNATI, OHIO

U. S.
¼" High Speed Drill.
2,000 R.P.M. under load.



U. S.
Electric Screw Driver
and Nut Setter.
450 R.P.M. under load.

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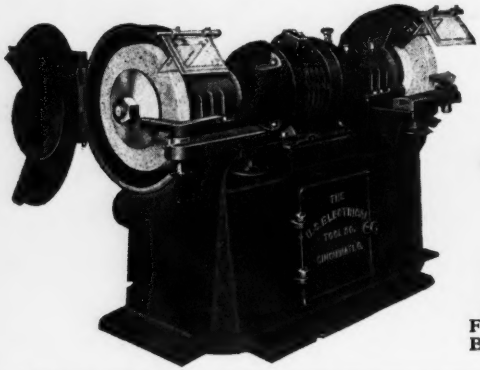

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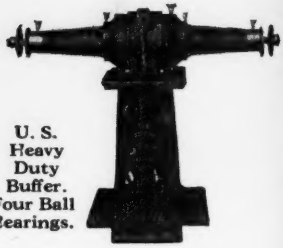

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